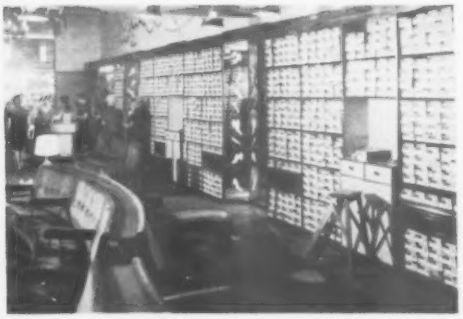
JULY 1961 3/6

AUTOMATIC DATA PROCESSING

JOURNAL OF MANAGEMENT AND INFORMATION SYSTEMS



UNDER CONTROL SHOES GALORE

The Hybrid Computer

'Sell until we tell you'

8 OF THE REASONS WHY HERTFORDSHIRE COUNTY COUNCIL

have chosen to install

THE NCR National 315 ELECTRONIC ACCOUNTING and DATA PROCESSING SYSTEM

– with the unique and revolutionary Random Access Information File

1 The pace of development within the borders of Hertfordshire is, to use a cliché, phenomenal. So fast, in fact, that the efficiency of the County Council's financial administration can be maintained only by the use of the most efficient electronic methods of accounting and data processing available.

2 *With its unique* RANDOM ACCESS INFORMATION FILE, HIGH-CAPACITY INTERNAL STORAGE, VERY HIGH OUTPUT CAPABILITY & EASE-OF-PROGRAMMING, *the* N.C.R 315 *is adjudged the most economical of all systems –both in terms of capital outlay and operating cost.*

3 The N.C.R 315's unique RANDOM ACCESS INFORMATION FILE not only provides–as no other system can–a split-second means of securing information, as required; it also provides the fastest-ever means of sorting and analysis.
(Just one Random Access File replaces *four* magnetic tape units!)

4 The extremely high processing speed of the N.C.R 315–plus the very high volume output of its line-printer–will eliminate all peak overloads and provide a comprehensive accounting facility capable of handling a rapidly expanding volume of work thus minimising the need for staff recruitment.

5 The 315's RANDOM ACCESS INFORMATION FILE provides up-to-the-*minute* EXPENDITURE DETAILS for Management Control, instantly and *on-demand*.

6 After an extensive study of available systems–mechanical, electro-mechanical and electronic–the N.C.R 315 was found to be the most suitable for the Council's requirements.

7 The superbly engineered, N.C.R designed, all-transistorized, solid state N.C.R 315 is built for the uttermost reliability under continuous-stress operating conditions.

8 N.C.R–long famed for the standard of its products and its service to all branches of Government, Local Authorities, Commerce, Industry, Finance and the Armed Forces–can be wholly relied upon to assure the full productivity of every N.C.R 315 system.

The British manufacturing of the central processor, associated component units and certain items of peripheral equipment is in the hands of **The Computing Division, Elliott Brothers (London) Limited**

NCR electronics

The National Cash Register Company Ltd
206-216 Marylebone Road · London NW1
Telephone: PADdington 7070

AUTOMATIC DATA PROCESSING

JOURNAL OF MANAGEMENT AND INFORMATION SYSTEMS VOL 3 No 7

JULY 1961

CONTENTS

Price for 12 issues post paid:
United Kingdom and Eire 45s.
USA $6.50
Canada $6.00
Other countries 45s. or Local currency equivalent

AUTOMATIC DATA PROCESSING

is published monthly by Business Publications Ltd.

Advertisement, editorial and sales offices: Mercury House, 109-119 Waterloo Road, London, S.E.1. (Waterloo 3388.)

Change of subscriber's address: Please notify publishers six weeks before change of address is to take effect, giving present address in full and new address.

BMC HAVE ALWAYS LOOKED YEARS AHEAD!

Take their decision, in 1956, to order one of the first business computers ever built in Britain. The payroll of the 20,000 check employees in BMC's Austin factory is one of the most complicated in the country. So complicated, that the facts and figures needed by management were seldom ready soon enough to be used for any but record purposes. And so BMC and EMI joined forces and set to work on the problem.

From the first, it was a close partnership between the two great firms at all levels, from directors down to departmental staffs; an unprecedented example of co-operation in computer development. BMC had the foresight to devote all its talent and resources to the operation. In fact, today's new generation of business computers owes as much to BMC as it does to EMI.

Months of combined research and analysis produced a detailed summary of the exact information and statistics the machine must handle. The computer that resulted still deals with the vast Austin payroll and supplies management with statistics in minutes, instead of weeks.

BMC went on looking years ahead! Even before their first computer was installed, BMC had ordered another—one of the new EMIDEC computers; this will handle sales invoicing, sales accounting, receipt and analysis of orders, production scheduling, sales statistics and stock analysis. A bold act, to order two such large machines at once! *Thank you, BMC!*

EMI

EMI ELECTRONICS LTD · COMPUTER DIVISION · HAYES · MIDDX · Tel: HAYes 3888 Ext 2319

EE145

Time to brainwash the boss

I HAVE every sympathy with the idea that one speaker put forward at a recent BIM conference* on operational research: that companies should invest in ' management services divisions ' which would comprise experts in organisation and methods and operational research as well as computer teams, and there is probably a sound case for saying that the OR function would be the most important in such divisions; but we have to be realistic and ask ourselves how likely it is that many companies—several score—would have the foresight to establish such ' management services divisions '.

Senior company executives who would never miss a trick in developing new products or making use of newly developed materials seem as blinkered as carthorses whenever ' company organisation ' (in its fullest sense) is put up for discussion. Enough has been published during the last two years about the very great possibilities inherent in OR techniques that one might expect every chairman or managing director would insist on having a personal OR expert at his side. Yet—wonder of wonders—this has *not* happened.

What can be the explanation? Senior executives don't read enough? Or they consider such techniques as being on a par with what goes on in the teleprinter room—interesting enough to show the odd benighted visitor—but hardly for them to dabble in? Or they think these new-fangled techniques are fine for others, ' but we do very nicely, thank you ' ?

Whatever the explanation—and a more fertile imagination could offer several more suggestions—clearly the message has not got through to the right places. And while the British Institute of Management and similar bodies, as well as computer manufacturers who have just begun to sniff the OR bone, have an obvious role in broadcasting the message, OR people themselves, by making considerable efforts to explain what they do in the simplest terms, stand to make a considerable contribution to British management.

The quicker they set to work, the sooner this will begin to happen.

* See report of this conference on page 24.

JUST 7 REASONS WHY

LEICESTER PERMANENT BUILDING SOCIETY

have chosen to install

THE NCR 315 ELECTRONIC DATA PROCESSING SYSTEM

1 AFTER a searching study of *all* available systems, the 315 was found to be the *only* one answering *all* the Society's requirements.

2 The 315's unique RANDOM ACCESS data file provides –as no other system can–a split-second means of obtaining as-required information *on demand*.

3 Also, the 315's Random Access facility allows new data to be entered for processing *in the order in which it arrives*, thus eliminating the need for pre-sorting into serial (account or code number) order.

4 The work-handling capacity of the 315–plus its all-purpose capability–is such that *all* the Society's accounting and data processing can be handled with ease–and still leave plenty of capacity for anticipated large increases in volume.

5 Due to the high output speed of the 315 system and its HIGH-SPEED PRINTER in particular, the twice-yearly payment of Interest will be reduced from a several-week procedure to just a matter of *hours*.

6 The 315 is a superbly engineered system specifically designed by NCR for high volume *business* data processing under the continuous-stress conditions of commercial use.

7 The productivity of every 315 installation is assured by The National Cash Register Company Limited, long famed for its service to all branches of Commerce, Industry, Banking, Building Societies, Finance & Government throughout the world.

The British manufacturing of the central processor, associated component units and certain items of peripheral equipment is in the hands of **The Computing Division, Elliott Brothers (London) Limited**

NCR electronics

The National Cash Register Co. Ltd.
206-216 Marylebone Rd · London NW1
Telephone: PADdington 7070

DATA DIGEST

Professor Kendall to join CEIR

Company recruiting top men

As the scientific and management consultancy firm, CEIR, opened up shop in earnest last month, a piece of news broke which caused some little stir. It was learned that Dr Maurice Kendall, Professor of Statistics at London University was to take charge of CEIR's Operational Research Statistics and Mathematics Departments in October.

This is a notable catch, for Dr Kendall is certainly one of the greatest authorities on statistical methods in this country, and is President of the Royal Statistical Society and a Past-President of the Operational Research Society. His career to date reads like a timetable of success; from Cambridge to the Ministry of Agriculture, becoming their head of Economic Intelligence; from the Ministry to the Chamber of Shipping in 1940, to be first the principal Statistician and later Assistant General Manager; and then in 1949, his present chair of Statistics.

His most notable achievement, apart from his standard works on statistical theory, updating Udney Yule's classic works, has been to create LSE's Division of Research Techniques, whose pioneer work on operational research and econometrics and social surveys has been given world wide coverage and acclaim. Dr Kendall will be able to build up his new department, expected to number about 20, on the same lines working closely with Dr Douglas, CEIR'S Director of Technical Services.

This is the second big catch for CEIR, who have set themselves the task of creating a team of 100 of the best programmers, consultants, mathematicians and OR men by the end of the year. A couple of months back the Admiralty's ablest programmer Martin Beale, was brought into the CEIR ganglion. Tom Cauter, CEIR's Managing Director, said that the recruitment figure was now 45 and they expected to reach 80 by the autumn and the hundred by Christmas. By then CEIR's salary bill, as some quick arithmetic reveals, will be in excess of £100,000 which with their computer hire overheads with IBM, would seem to make their annual expenses figure rather more than £250,000.

KENDALL
A notable catch

City Centre

will be bureau for brokers

Opening in September somewhere in the City—it is most likely to be Moor House, in Moorgate—is a computer service bureau designed exclusively for use by the smaller professional firm, the stockbroker and jobber, the insurance broker, the unit trust company. This bureau is the first to be installed by National Cash Register Co—others are scheduled to follow in the bigger provincial cities—outside their main headquarters in Marylebone. (There is an overflow centre being built at Neasden, with a National-Elliott 405, but that is very much the daughter and dependant of Marylebone.)

Equipment at the City centre will be, initially, a National-Elliott 803 with magnetic film files. However, it is planned to augment

this with an NCR 315, which is better suited, when equipped with random access memory units, to the small-scale, tight schedule working, which NCR envisage will be the main tasks of the centre.

Jobs currently lined up for servicing when the centre opens in September are the evaluation and analysis of portfolios and the calculation of stock price statistics for investment analysis. Such work as the calculation of insurance risks and premium rates, unit trust records (see page 9) and share price indices, is being done already at Marylebone. But it will be more convenient to have a centre within walking distance for a messenger, so that the data can be rushed for processing and back to the customer with shortest notice. In this way up-to-the-minute information can be provided in time at an economical rate.

Other centres are likely to follow. NCR have sold their National 31 to customers on the merit of producing by-product tape for computer processing. They now find they have to provide the computer to enable the servicing to be carried out. Which sounds like a penalty-of-success story.

New Chairman

Establishment man chosen

That empty chair has been filled. From the Ministry of Defence comes dapper, bespectacled, Sir Edward Playfair to take over the chairmanship of ICT, vacant since the death of Sir Cecil Weir.

ICT are now having a flush of success. Nine new orders are announced this month alone, mostly for the 1301 computer. The company recently made a rights issue of 2,500,000 ordinary shares. But they will need this success and this capital—and more besides—if they are to be able to keep up with the world-wide selling and research programme of IBM—whose research budget in the USA alone is more than the total budget of ICT. Perhaps Playfair with his background of warlike pursuits—he was at the Ministry of War before becoming Permanent Under-Secretary at the Defence Ministry—will be able to carry the computer war into the enemy's camp.

PLAYFAIR

From ministry to boardroom

Progress made

EMI offer spare capacity

Seven months ago EMI took delivery of one of their own Emidec 1100 computers at their Manchester Square, London, headquarters. Now it is announced that this machine is about to *begin* work on three jobs.

First, it is to prepare invoices, royalty payments, for 24,000 record titles. This shows a creditable advance in record production, since the original forecast on what the machine would do mentioned 12,000 titles; the figure of 3,000 invoices to be prepared daily remains constant. Also to be prepared, as scheduled, is the payroll and labour cost analysis for 14,000 employees.

Now, it seems that there will be some time available on the computer such that new tasks can be undertaken. EMI have therefore set up a program testing service, which will allow customer's programs to be tested before their own hardware is installed; this will give valuable practice to fledgling programmers, and allow a two-way traffic in experience with EMI's permanent programming staff.

Also computer time will be available for time hiring. As the Emidec is a medium to fast computer the hire rates will have to be geared to make it competitive: one service organisation recently said that they had transferred hiring time on a medium speed computer to a very fast one, because it was more economical to use, even at a very much higher hourly rate—a 56-hour job was reduced to a 120-minute job.

Same again

. . . only more of it

' If your machine fails ' said a borough Treasurer to City Treasurer, A J Barnard in the early days of Norwich City's 405 computer, ' you'll put back computer developments in local government by ten years '. Happily, the machine did not fail, and the Norwich installation has become the standard for accounting installations (being used as an example in the Institute of Office Management's authoritative *Sales Accounting Methods*).

Now after four years the ' veteran ' is to be replaced, by another but larger 405, with faster input-output facilities, a bigger internal memory (and three magnetic film units instead of two).

Why not expand the existing computer? Treasurer Barnard explained the thinking behind the new plan. ' We found that for various reasons we faced an increase in the volume of work of something of the region of two-thirds. When we told NCR of this, and suggested that we should expand our existing computer, they suggested that we should " trade in " our present 405, and replace it with the newer model. That suited us very well. It meant we should be able to work our

existing computer right up to the last minute, then make the change-over without any interruption of the day-to-day processing. In addition, this will mean that we will not have to re-program, though we will be modifying our routines in due course to make use of the bigger capacity of the new machine.'

'The cost? Rather less than that of a punched card installation. The arrangement is that we will send back the old 405 and pay in addition £15,000. That is a very good bargain for us, since we could not possibly get a machine of this capacity for anything like that price under any other arrangements.'

County Accounts

Later a service centre for district councils

Another local authority feeling the pinch of expansion—with four new towns and a great deal of industrial growth—is Hertfordshire; this has led to a council decision to order a NCR 315 to handle its payroll and costing records, expenditure analyses and stores control.

The computer will be able to absorb any increase in the volume of financial work in the next ten years, and with an expected three-fold expansion—based on the trend over the last decade—of expenditure on public services.

The initial task will be preparing the payroll for more than 20,000 council employees, including teachers, firemen, bureaucrats, etc. In addition to producing the payslips, bank credit slips and cheques, detailed analyses will be produced relating to costs and other factors.

A comprehensive electronic book-keeping system is to be devised to merge many different jobs, and to control creditors' payments, cash and bank reconciliations, highways costing and accounting, invoicing, and a number of other expenditure items. In its downtime the machine will carry out calculations for road and bridge construction, and—a new departure—act as a service centre for district councils and other bodies lower in the local government hierarchy.

Marking Exams

Computer sets standard

As forecast in our January issue the anticipated order for a 1301 for London University examinations board has matured. This computer is to handle an anticipated work flow of 800,000 examination papers, from 170,000 GCE candidates. Work includes the allocation of candidates to examination halls, avoiding timetable clashes and undue travel. Checking the validity of entries, standardising of marking for all the various examiners—2,000 in all—are among the factors involved. As might be expected, the technique used for recording the individual candidate's marks is to be mark sensing.

Bank's initiative

Special equipment devised

Barclay's Bank, who are shortly to open a computer centre for their Emidec 1100, have become their own hardware designers. Faced with the problem of meeting deadlines, and with having to transmit data over lines to and from the computer centre with the risk that a distorted data block could hold up computer processing, Barclay's research department set to and designed their own input checking equipment, known as 'Ice'. This equipment allows all tapes received to be checked 'off-line' prior to processing—at a speed of 50 characters per second—so that faulty tapes can be amended. The computer still carries out its own tests, but the elimination of simple errors by parity check and format test will give greater overall efficiency.

Another bank in the news is the London Trustee Savings Bank which has ordered an ICT 555, as the first step in a mechanisation policy which envisages the eventual introduction of an ICT 1301. The system which includes a 555 and a 900 series tabulator is to be a centralised posting system for the Bank's 73 branches.

Union sextet

Three for South African railways

South Africa, a home from home for ICT who are well entrenched there with punched card complexes and at least 16 small computers, has taken to the magnetic tape 1301 computer. Six of these equipments, worth in all about £600,000 have been ordered; three for South African railways, one for the City Council of Johannesburg, and two for expatriate companies, Caltex (Africa) Ltd, the oil people, and steel tube manufacturers, Stewarts and Lloyds of South Africa. The installations are located in Capetown, Johannesburg and Durban

Tape checking devise was developed by Barclays Bank but when a bank has to develop its own equipment, then some manufacturers must be missing out

A decisive advance in automatic data processing

KDP 10

The 'ENGLISH ELECTRIC' **KDP 10** Data Processing System incorporates a number of unique design features. It is extremely flexible and is designed to handle a wide variety of commercial data processing applications. **KDP 10** is a complete system using alphanumeric data and has magnetic tape, punched tape, punched card input/output, together with printed output.

To ensure maximum operational reliability solid-state devices and printed circuits are used throughout. The high speed store is available in increments of 16,384 character locations up to a maximum of 262,144 locations. Each location is individually addressable and can store any one of the 64 alphanumeric characters in the system code. **KDP 10** has total variability of item and message length, but fixed or fixed-variable lengths may be used.

Peripheral equipment includes tape punch and tape verifier, monitor printer, high speed line printer, paper tape reader, punched card equipment, and magnetic tape units operating at 33,333 or 66,666 characters per second.

If you have a data processing problem why not consult 'ENGLISH ELECTRIC' and receive the benefit of their unrivalled expert knowledge as designers, manufacturers, and ***users*** *of electronic computers.*

'ENGLISH ELECTRIC'

data processing systems

DATA PROCESSING AND CONTROL SYSTEMS DIVISION, KIDSGROVE, STOKE-ON-TRENT. Telephone: KIDSGROVE 2141

The English Electric Company Limited, English Electric House, Strand, London, W.C.2

EDC. 37

in the case of African Railways, in Capetown for Caltex, and in Vereeniging for Stewarts and Lloyds.

Promotion

by knight's move

Promoted to assistant controller of administrative services at Boots Pure Drug Co, is Mr Keith Wyld, ex-Nottinghamshire chess champion, and current head of Boots' O and M department. His new imposing sounding title means that he will be deputy head of the computer division and data processing services, including the Emidec system (described in AUTOMATIC DATA PROCESSING, October, 1960), which handles sales control and invoicing routines.

WYLD

Number two in computers

Boots have just placed a £40,000 order for a second data processing system, a De la Rue 300 Series system, whose main task is to be to produce chemical manufacturing cost information. The data processing complex will comprise the basic minimum—a program unit card reader/punch, printer, electric and electronic calculating unit—but it may later be expanded by the use of magnetic tape units, and possibly a second printer. This is the first 300 Series system to be sold, in Britain.

Tower Tabulating

Blackpool Corporation centralise

A punched card complex worth £40,000—including an electronic calculator, and three tabulators—is to undertake Blackpool Corporation's wages and salary routines, as well as income and expenditure analyses, and payment routines. This equipment is to replace 36-column punched card systems.

ICT, who will provide the new equipment, say that it is due to be delivered late this year in order to be ready for the beginning of the Corporation's financial year. The decision to change from the 36 to the 40-column system was made following an investigation by Organisation and Methods Consultants. They recommended that the control of accounting and costing procedures be centralised under the Borough Treasurer. With the expansion of work for Borough Departments, in fact half as much again, according to the Norwich criterion, it must be wondered how soon the capacity of this complex will be reached.

Computer on Trust

THE service bureau is fast proving the 'stockbrokers' friend'; more and more the computations relating to industrial share indices, share registers, and actuarial calculations in stockbroking and insurance operations are processed through 'the computer laundrette'. However, the new boy in the share pushing world, the unit trust, has not so far made use of this service; and the British Life Units, an off-shoot of British Life Office Ltd, the well-known insurance company, is almost certainly the first unit trust company to take computer time, to compile and update its holdings register and organise its half-yearly dividend distribution.

British Life Units, as their name suggests, are putting forward an entirely new concept of trust offer—investment coupled with free life assurance. The first block offer was scheduled to be made in March of this year, and the trust were faced with the problem of how to cope with a certain immediate demand of several thousand would-be unit holders for varying numbers of units. For each of these holdings a certificate had to be produced, with full details of the holder's name and address, number of units, and other details for the life assurance side; also a complete register had to be compiled for the trust office itself, and notification of each unit holding had to go to the Midland Bank, who were acting as the trustee for the operation. There were other complications such as buying back and resale of units, the fortnightly updating operation, and the half-yearly computation and printing of dividends.

After consultation, it was decided that this whole operation could feasibly be done on a computer, and that it would be economical to hire time at a computer centre. At this point the National Cash Register Company came into the picture, and it was their Marylebone service centre that was selected to carry out the operation. The trust agreed to pay a fixed fee per unit holder on registration, followed by a fixed annual maintenance fee.

The pilot block share offer was made by British Life Units be-

'our Ferranti computer certainly helped us'

Ferranti

Here are some of the important companies who have installed Ferranti computer systems for their contribution to business efficiency.

Babcock & Wilcox, Limited
The de Havilland Aircraft Co. Ltd.
The General Electric Company Ltd.
Imperial Chemical Industries Limited
C. A. Parsons & Company Limited
Shell International Petroleum Company Limited
The United Steel Companies Limited
Vickers-Armstrongs (Aircraft) Ltd.

So say more than 50 leading concerns who have Ferranti computer systems in everyday use. Ferranti's working experience with computers is exceptional. For one thing, they were the pioneers: Ferranti built the first electronic digital computer ever marketed.

Secondly, Ferranti produce not one, *but a full range* of computer systems, unequalled in scope by any other manufacturer in Europe. Your Ferranti system can be adapted to changing needs —for greater volume, for new data-processing commitments.

Thirdly, Ferranti have trained more than 1,000 programmers, who are helped by a half-million pounds programme Library and the thoroughly expert Ferranti after-sales service.

Many businesses with intermittent needs make use of the Ferranti Computer Centre, where you can always see a computer at work. Write or telephone for an appointment: **Ferranti Ltd., London Computer Centre: 68/71 Newman Street, London, W.1. Museum 5040, and at 21 Portland Place, London, W.1. Works: West Gorton, Manchester 12. East 1301.**

FERRANTI

RANGE OF COMPUTER SYSTEMS

PEGASUS · MERCURY · PERSEUS · ARGUS · SIRIUS · ORION · ATLAS

FERRANTI LTD., HEAD OFFICE: HOLLINWOOD, LANCS.

tween 20 and 24 March. As the application forms came in, they were batched and sent by messenger to the computer centre. At the centre the applications were passed to the tape punching section and the information contained was converted via a Creed 77PN manual tape punch to 5-channel tape. Information entered on the tape comprised:

(1) The full name and address of the applicant (the full name serving later to identify the record, instead of using a reference number).
(2) His date of birth (needed for the insurance side).
(3) The date the application was made.
(4) The number of units required.

After punching the tape was verified, by punching a duplicate tape and comparing for discrepancies on a Creed 90 verifier. Any discrepancies noted on the forms were referred back to the unit trust for scrutiny and amendment.

When all discrepancies had been ironed out the verified tape went forward to the computer for processing. The computer used for this job at the service centre is the National-Elliott 405. This is a medium-sized computer with magnetic film storage; the total capacity of the store is 1,250,000 alphabetical characters (see ADP Survey, October, 1960). The tape was read into the computer at a speed of up to 1,000 characters per second, and during the first testing run on the computer, the information contained on the tape was checked against the built-in checks incorporated in the computer program. This check ensured, for example, that the number of characters in the name and address was of a size enabling them to be incorporated in the form field provided for the print out. When these checks had been carried out the tape was ready to undergo the main computer run.

The main computer run stored the holder information in the magnetic film files, and the share certificates were printed out on the output printer, at a speed of 600 lines a minute. To protect against forgery the number of units issued to each applicant was printed on the certificate in letters as well as figures. The certificates were produced in a triplicate set, enabling the original to be sent to the holder, a register sheet to the Midland Bank—the trustee—and another register sheet to be kept by the unit trust for reference.

The filing of the records on the magnetic film files and the printout of the holders' certificates was completed, and the certificates returned to British Life Units within 24 hours of the receipt of the applications. This meant that the unit trust was able to dispense with the usual receipt/contract notes, normally sent to each applicant when his request is received, showing a saving on clerical labour and postage costs.

The service centre is now carrying out a fortnightly updating operation. In addition to new applications, there is the complication of the buy-back/resale operation carried out by the trust. The unit holder may at any time resell his holdings to the trust, who are bound to buy them back. In order to reduce stamp duty to a minimum it is necessary to resell these units within two months. Therefore there must be a constant movement of holdings, new holdings being created by other accounts closed. These movements are dealt with in the fortnightly updating run. The trust issues a contrast note to the new purchase and sends a copy of this note to the computer centre. These notes are converted to tape and compared with the existing records in the magnetic film file in the updating run. At the end of the run the new certificates are printed out. Also produced on the updating run is a report showing the state of current holdings, and other information concerned with stamping control.

The success of the handling of the March block offer has meant that not only will future block offers be handled in this way, but also the trust holdings created prior to the investment plus life insurance offer are also being taken over by the computer. At the moment two separate regisisters are being maintained on magnetic files, but these will eventually be merged.

The first distribution of dividends will take place in the autumn but the program for this operation has already been written. Basically it envisages the production of dividend counterfoils showing the amount of income based on a rate per unit. Holders who have purchased units since the previous distribution will also receive a variable tax free payment per unit.

Some unit holders mandate these distributions to their bankers so the computer will produce the counterfoils in bank sequence. Distributions sent straight to unit holders will be accompanied by cheques also produced by the computer on its fast line printer. Finally, it is envisaged that the computer will take over all the daily evaluations of the unit trust's funds; this will entail the deduction of management charges, and the ascertaining of double taxation on overseas corporations, for which relief has to be obtained, and other routines at present done manually.

Charles Ross, who engineered this application and is now in charge of the new NCR City Computer Centre, said ' I reckon developments on the computer side over the coming months will mean that the administrative costs of the unit trust movement can be substantially reduced, and I hope that even smaller holders and investors will be able to participate in the trusts at economic rates for the managers.'

Jackie knows something . . .

She knows, for example, that "Paraflex" provides the answer to many of her problems in fast output of multiple-part continuous stationery.

She knows, too, that "Paraflex", with its copies bonded together with floating carbons, ensures trouble-free operation at all speeds on all types of data processing machines, from electric typewriters to electronic high speed printers. When used with "Formaliner" Above-Platen Form-Feed Equipment, perfect control and alignment of copies are maintained throughout the complete operation.

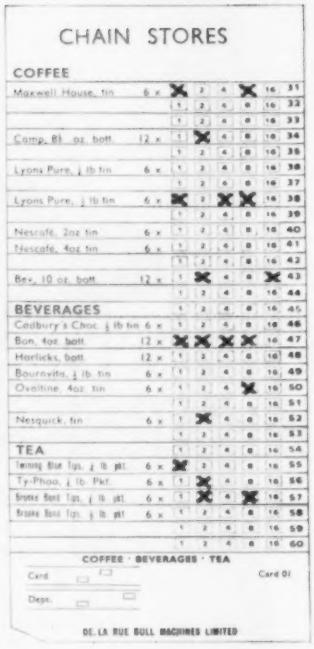
Did you know? Our A.D.P. Consultant will be pleased to tell you more.

**PARAFLEX is a Registered Trade Mark of Lamson Paragon Limited*

LAMSON PARAGON LIMITED

PARAGON WORKS, LONDON E.16. Telephone: ALBert Dock 3232

MEMBER OF THE LAMSON INDUSTRIES GROUP

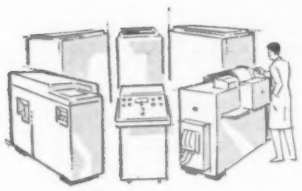


data processing links the chain . . .

. . . between branch and warehouse, between order and goods. The link is forged by De La Rue Bull. It offers a greatly improved method of receiving and despatching orders without the frustration of error and delay. Stock records, too, are maintained with up-to-the-minute accuracy.

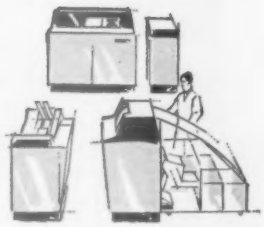
The system is new — an ingenious demonstration of punched card versatility. New because every card has a dual role. First, as a pre-printed order sheet on which quantities required are marked simply by a series of crosses. Secondly, after automatic magnetisation and punching of these marks, as the computer input medium.

The computer will then produce *in one single progressive operation:*
INVOICES · DESPATCH LISTS · STOCK ISSUE SUMMARIES
NEW STOCK STATEMENTS · RE-ORDER LISTS



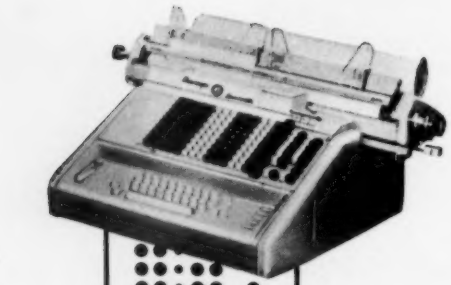
THE GAMMA 3 COMPUTER (*left*)
is an electronic calculator with variable drum storage of up to 200,000 decimal digits. With a basic on-line printing speed of 150 lines per minute, invoicing and its associated operations can be carried out as a single integrated process.

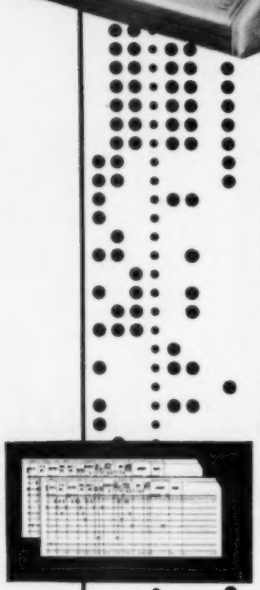
THE 300 D.P. SERIES (*right*)
is an expansible unit system, fully synchronised at a speed of 300 cycles/lines a minute: though rates of reading, calculating and printing may be increased by using further units. Storage is available in the form of a magnetic drum or tape units.



DE LA RUE BULL MACHINES LIMITED
114/118 Southampton Row, London W.C.1. Tel: CHAncery 5725
Gamma 3B **300 DP Series** **Gamma 60**

BM22b



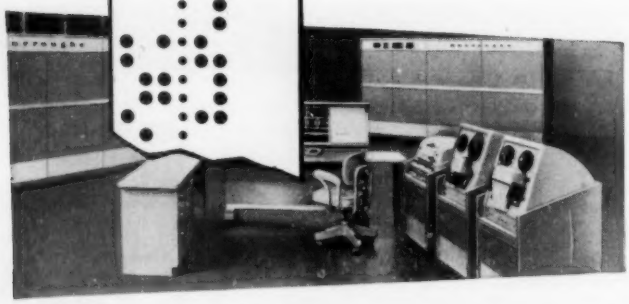


THIS IS YOUR

DIRECT LINE

FROM ACCOUNTING MACHINE TO DATA PROCESSING...

BURROUGHS SENSIMATIC CONTROL-INPUT EQUIPMENT



Produces records as it punches card or tape

Burroughs Sensimatic Control-Input Equipment permits the input problem to be tackled at its source, i.e. the department or branch where the original media is first processed. Here, punching of Numerical or Alpha Numerical data may be undertaken with equal facility by the Burroughs Sensimatic Accounting Machine in one operation.

The machine is so simple that anyone can use it without special training.

The moving, electrically-operated carriage permits the production of one or more records at the same time as card or tape punching is taking place. An automatic line proof of accuracy of the accounting information punched is obtained, and up to eighteen twelve-digit control totals are accumulated and printed.

Accurately punched cards or tape can be sent to the data-processing department with a legibly printed record. Documents for despatch to customers are immediately available and the originating department retains its own vital historical record together with the original media.

DECIMAL CURRENCY!
All Burroughs machines can be converted to decimal currency

By appointment to H.M. The Queen Manufacturers and Suppliers of Adding Machines

See Burroughs first

BURROUGHS MACHINES LIMITED, 356/366 OXFORD STREET, LONDON W.1
Telephone: HYDe Park 9961

Accounting Sales and Service facilities from 56 centres in Great Britain and Eire. Factories at Strathleven and Cumbernauld, Scotland

UNDER CONTROL
SHOES GALORE

Invoicing Stocks Production — Under Control

Lionel Trace

What is significant about the systems that C and J Clark Ltd have adopted is not merely the smooth working that the company, as manufacturers and sellers of shoes, obtain — but the ideas behind these systems, which any company that makes consumer articles and sells them to retail outlets would do well to study

EVEN a cursory glance at the main features of the business of C and J Clark Ltd of Street, Somerset, would suggest the company had what might be termed 'classic' data processing problems: a large volume of invoices to prepare, considerable finished stocks to control, and the need to match stocks and production with orders.

Last year Clarks produced 43,000 pairs of shoes each working day—a total of just under 10½ million pairs a year—while Clarks' executives reckon the company will finish the current year with nearly 12 million pairs of shoes notched up.

Unlike other shoe manufacturers, Clarks do not specialise in a few lines of footwear, but offer a very comprehensive range of shoes and other footwear. The company's headquarters in Street is in fact the hub of a manufacturing complex that comprises some 20 factories, all situated in the West country, and from these about 3,000 kinds of shoes emerge. Clarks reckon to make their shoes on average in 10 sizes—and in effect this means that some 30,000 varieties of shoes have to be produced and stocked.

Clarks sell through 3,000 outlets, mostly retail and multiple retail. In addition Clarks shoes are sold through Peter Lord shoe shops, a chain of shops wholly owned by Clarks, which handles about 10 percent of the company's output. Clarks say that the chain serves as a barometer, for in addition to what their customers tell them about their sales of Clarks shoes, the company have the means of assessing accurately how well certain lines of shoes sell.

The orders that Clarks get can be divided into two categories: orders which have to be fulfilled by some date ahead (*eg.* within three months, though a specific date is always given), and 'by return' orders which get immediate attention and are met from stocks in a centralised warehouse in Street. Roughly three-quarters of Clarks' shoes sales are of the first type—forward orders—the remaining being met from stocks: this means that Clarks manufacture both to fulfil specific orders and to build up stocks, though in fact the whole output of shoes is first sent to the centralised warehouse.

To sell to the retail trade a range of some 30,000 items of 'consumer goods' the company employ salesmen, and resort, of course, to the inevitable catalogue which is issued to every customer, along with a supply of pre-printed order forms.

Together, the catalogue and the preprinted order form, may be said to constitute the first link in a system of data processing that comprises preparing invoices, statements and sales statistics; stock recording, and production scheduling—and which keeps busy two computers and a battery of punched card accounting machines.

FOLLOWING AN ORDER THROUGH

An idea of the ramifications of this system can be gleaned by first considering what happens when an order is received. The pre-printed order forms which Clarks send out to customers are embossed with each customer's name, address and code number by Adrema plate. A customer, after consulting the catalogue, orders by entering on a form shoe numbers, pairs required in total and by sizes, and the delivery date of *his* choosing. Each order form has two carbon copies, and the customer despatches the order and one copy to Street, and keeps the remaining copy for his own reference. The company say 95 percent of their customers use their forms, and this makes for easier initial handling.

When orders reach Street, by referring to a large display board which gives the despatch period planned for each shoe number—in some cases the despatch time could be 'by return'—clerks enter manually on the order when it will be executed.

These details are automatically duplicated on the copy of the order (the top sheet is carbon-backed), and this copy is returned to the customer to acknowledge the order. This, in fact, is done for only 'forward' orders.

The next stage is for each top copy of both sorts of orders to go to the card punching section, where the information on each order is transferred to punched cards. Thus the customer's code number, the order number, the shoe code number, the num-

Random access stores of this type are key features in Clarks systems

ber of pairs required and the delivery period are punched. Clark prepare one card for each type of shoe, so that for an order requiring four types of shoes four cards are punched.

These cards are prepared for use in company's computing system. Clark have two IBM 305 Ramac computers* and both of these are currently working. Both computers are used to do identical tasks, and are worked for one shift only. The company say they require two computer systems because the volume of transactions is now too great for one machine.

As both machines do identical work, for the purposes of describing procedures, we can consider both Ramacs as one.

Stored away in the Ramac file memory are the 3,000 names and addresses of Clarks customers, and also stock figures for the 30,000 types of shoes the company make. The stock records comprise such information at the current ' free stock ' levels, purchase tax, and the retail price, as well as total stock figures for each style of shoe irrespective of size.

By return order cards are read into the 305, and the customer number in the cards causing the invoice address and the ' ship to ' address of the customer to be read from store and printed. The stock record for all possible sizes of the required shoes (as indicated on each card) is amended, and the allocation of shoes for despatch as well as the invoice extensions are printed out. This procedure is repeated for all order cards relating to one customer, and totals are printed at the bottom of each invoice. As this is done, a sales ledger card for that invoice is simultaneously punched: these cards are later used for preparing statements and for statistical purposes. If a customer's order includes styles of shoes which are not immediately available, a note of this is printed out on the invoice and at the same time a ' back order ' card is punched out. Back order cards take priority over fresh orders when invoices are prepared the following day.

Invoices come off the Ramac printer (this in fact is an IBM 421 accounting machine) as three-part sets: the top copy is the real invoice, but acts as an advice note to inform the shoes are on the way, a second copy is despatched with the goods, and a third is sent to the accounts department and filed there.

Forward order cards are dealt with in a slightly different manner. They are processed by the 305 in the way by return orders are, but instead of printing out invoices, at this stage a packing note is produced (for the warehouse) and an invoice card is punched out; this card contains all the informa-

* 305 Ramac computers, which look like oversize jukeboxes, feature disc memory stores—these permit random and immediate access to any information stored within the systems. A typical Ramac store has room for five million characters of information.

tion required for printing an invoice. These invoice cards are filed until such time as the order is due to be despatched to the customer. The cards are used to produce invoices, not on the 305 system, but off-line, as it were, with a 421 accounting machine. [In addition to two Ramac 305s Clarks have five 421 accounting machines, two of which are linked to small electronic calculators—IBM 604.]

As fresh supplies of finished stocks reach the warehouse in Street, the stock records in the Ramac system have to be updated; to do this pre-punched cards are pulled for the new stocks, and sent up to the computer department. With an average daily output of 43,000 pairs of shoes from the factories, and with the need to update the records each day before the invoicing runs start the next morning, using pre-punched cards saves time, and indeed it is doubtful whether Clarks could update their stock records without recourse to this system. It can happen that shoes delivered to the warehouse have been damaged by the factory and when this occurs the shoes cannot be credited to the 'live' stocks. For damaged shoes, the related cards are marked by hand, and then these are marked sensed and punched.

How the pre-punched cards are prepared gives considerable insight into how Clarks have managed to inter-relate various procedures through their computer system.

Each week summaries of forward orders, which are prepared from the forward orders cards on the conventional card equipment, are fed to the Ramac system to compare stocks in hand and work in progress against orders. Total orders and work in progress for all styles of shoes are also stored in the system so that reports can be produced showing the difference for each type and size of shoe between customer orders and shoes available from stock or in progress.

These reports are used by Clarks planning department when they decide each week how many shoes of each type the factories should produce. The planning department orders shoes from the factories by issuing work tickets—these detail the type of shoe to be made, in what sizes, etc—and each work ticket is an order for 12 pairs of shoes and is allocated a number. For each work ticket a card is punched: these in fact are the cards which are pulled when the warehouse takes delivery of the output of the factories.

However, before this happens the work ticket cards are first fed into the Ramac system, where an inventory is kept of work in progress.

This means that as soon as batches of shoes reach the warehouse and the appropriate job ticket cards are pulled and sent to the computer department, in one run both the work in progress record as well as the finished stock record can be updated: the number of shoes that have arrived in the warehouse is subtracted from the work in progress total and added to the finished stock total.

Outstanding work tickets cards are tabulated weekly to enable the planning department to chase up shoes ordered on the factories which are overdue at the warehouse.

Clarks took delivery of their first Ramac system in December 1959, and the machine went into operation on January 1, 1960. The second machine began work at the beginning of this year. With their computing and punched card equipment Clarks have achieved two results:

1. They have mechanised the purely routine work of preparing invoices, statements,* and records of stocks held.
2. They are now able to produce quickly reports and analyses, and to keep track of production output at their 20 factories.

The advantages that emerge from their system of processing data can be further pinpointed: the company now have a clearer picture of outstanding orders, and actual output from the factories can be gauged more accurately, so that shortages can be anticipated and customers' enquiries better answered. Controlling stocks of shoes through the computer is particularly valuable, for with tens of thousands of shoes going in and out of the warehouse each day, trying to control stocks through ledger entries (as was done previously) was like trying to count the ants on a moving anthill.

* How statements are prepared has not been elaborated in this necessarily brief outline.

All shoes come to the centralised warehouse in Street, but its stock records are kept on the computer systems.

The Hybrid Computer

THE hybrid computer—a completely integrated analogue and digital system—promises to be one of the major automatic data processing milestones of the 1960s, giving the key, through utilising and maximising the strong points of each machine, to a new and vastly more sophisticated level of data processing than has ever been exploited before.

During the past few years, digital and analogue systems have been linked together for many purposes. However, the utilisation of such systems for general purpose computation and simulation has not been as widespread as their apparent advantages would seem to warrant. There are a number of reasons why this is so. Undoubtedly one of the chief limiting factors has been the digital computer's fundamental versatility. On the basis of breadth of problem-solving ability, the digital computer is unsurpassed. Nevertheless a limit of another type is now rapidly being reached; for many of the more complex problems, an economic obstacle of major proportions must be confronted and overcome.

The complexity of many scientific and engineering problems and the requirement for more reliable analyses of these problems have increased the overall running times to such a point that alternate methods of analyses must be considered. On the other hand, the analogue computer (although extremely slow by digital standards) can solve many problem variables simultaneously. Although the time required for solution is small, the analogue computer is awkward to use. It does not approach the versatility of the digital computer and (because of its limited range) must be scaled. Thus, resolution capability is lost and accuracy is limited.

One obvious solution to this problem is the combined analogue-digital computer system. Utilisation of such a system not only makes it possible to conduct more economic analyses of certain classes of engineering and scientific problems but in some cases is actually a far superior method of analysis. Problems which deal with some configuration of a combined system, for example, could be economically and adequately simulated on the general-purpose hybrid system. Another important application area comprises systems which require transport delay and logical capabilities such as nuclear reactors with *predictive* and *adaptive* control systems, that is to say, systems whose parameters are automatically adjusted to optimise the response to all demands.

EXISTING DIGITAL COMPUTERS ADAPTED

Although no completely integrated analogue-digital computer has been designed and assembled from the drawing board to a finished prototype, a considerable amount of work has been done on development of links to connect existing computers. Engineers in General Electric's missile and space vehicle department recently completed a hybrid computer link which connects a general purpose analogue computer with a large scale digital computer. In this system, the analogue computer can be placed completely (except for patching) under the control of the digital computer. The digital

AMERICAN REPORT

from John Diebold and Associates, New York

Systems which make use of both digital and analogue techniques could come to play a big part in the management process: they could be used to evaluate, analyse, implement and monitor complete projects and operations in large organisations

computer exercises control for automatic setting of plots through the use of an automatic-digital-input-output element. Seven basic requirements were incorporated in the original specifications:

> Complete control of the problem was invested in the digital computer program, allowing a 'hands-off' mode of operation.
>
> Linkage of the two computers could not limit their use as independent systems.
>
> Complex tasks were to be assigned to the digital computer.
>
> Reliability and confidence in results were to be achieved by transistorisation, error detection, and diagnostic routines.
>
> The ' link ' was to be designed with general purpose features in order to take advantage of the general purpose nature of the analogue and digital computers.
>
> The link was to be compatible with the missile department's IBM 704 or 7090 digital computers. Error introduced by conversion elements was to be no greater than 0·05 percent of full scale.

A number of evolutionary steps must still be taken before full versatility of a combined system can be completely exploited. General Electric engineers are now planning to develop a digitally-controlled patching system. This will make it possible to fully digitalise input/output operations on the analogue computer. Coinciding with this development will be the design of an analogue translator which will serve as a compiler for the analogue computer and should make programming and production running as simple as it has become for the digital machine. Once this equipment is developed and refined, programming and timing on the hybrid computer will be routine operations. At that point, round-the-clock scheduling of the computer will be feasible.

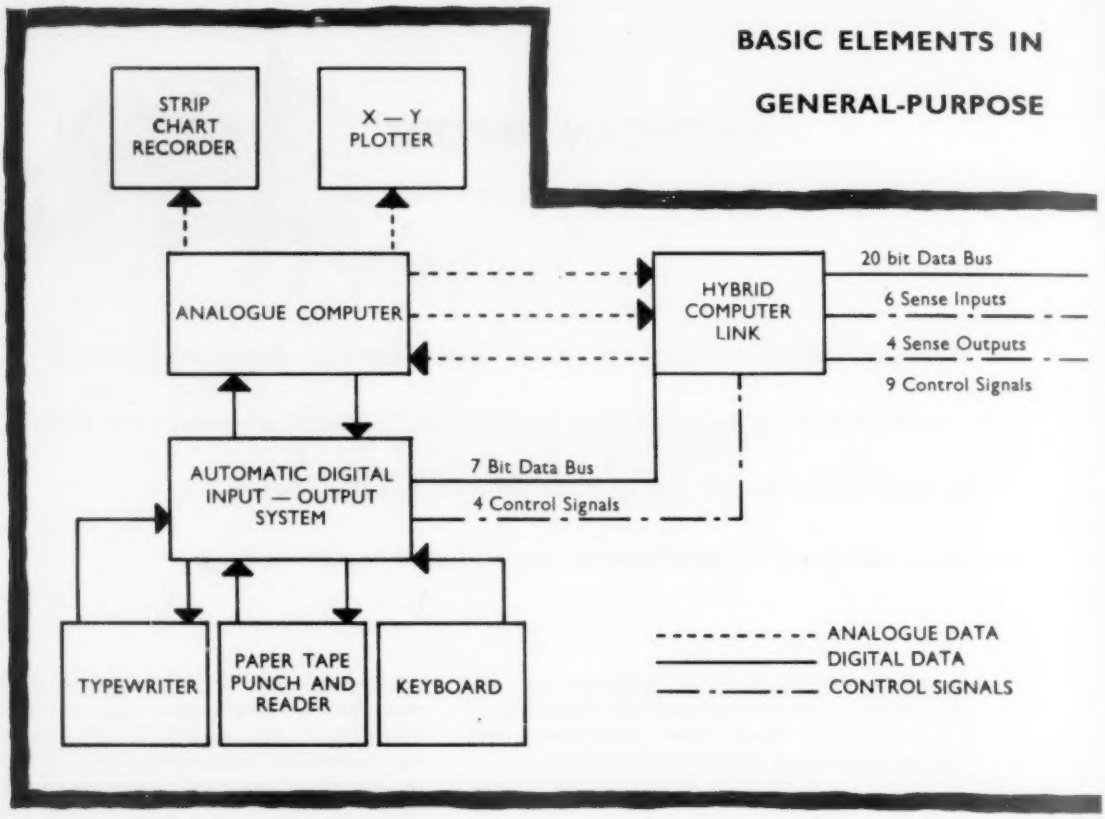
According to General Electric, the most radical changes which will take place will be in the approach to computer systems design itself. Operations such as multiplication, for instance, will take place during the conversion. This, in effect, will provide automatic scaling. Basically, however, the computer system will be known best for its extreme flexibility and its capability for serving as a simulator for a wide variety of problems.

THE POTENTIAL FOR COMBINED SYSTEMS

Possibly the most interesting and significant combined systems will be used for integrated planning and control. Three classes of systems will perform this function:

(1) *Process control*—applications of combined analogue-digital systems for continuous real-time control of physical processes such as chemical and petroleum processing, and public utility operations.

(2) *Production control*—combined systems to plan and control the discrete operation of machine tools, sets of machine tools, and



production lines using the analogue service as the tool control unit, and the digital device as the means to coordinate and direct production operations.

(3) *Strategic planning and control*—applications for total planning, long range analyses, and command control.

COMPLEX MODULAR DATA PROCESSING

By 1965, equipment organisation problems implicit in the design of combined digital-analogue systems should be solved. At that time, polymodular type data processing systems will be available. These systems will involve a complex of processors, organised about a switching central. The logical processor, memories (slow as well as high speed), inputs, outputs, and display modules will be grouped around a central communications unit which serves as the priority control. This will provide the means for data transmission between the various modules, as shown on the accompanying diagram.

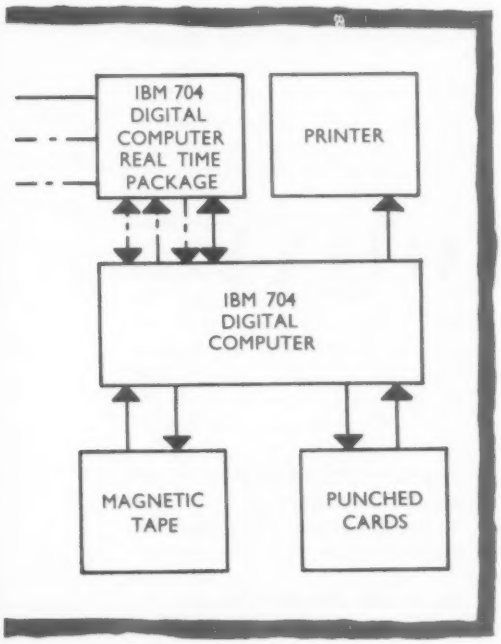
In future systems of this type, the communications 'central' will undoubtedly have the logical capability to transmit data to and from the various modules without explicit programming instructions. Some kind of problem-oriented language will also be used to permit direct interrogation and use of the analogue and digital modules. Inasmuch as digital differential analyser modules can perform some of the tasks normally handled by conventional analogue units (with an order of magnitude improvement in accuracy and repeatability of the solution), it is quite probable that digital differential analyser equipment modules will also be available.

USE OF MONTE CARLO TECHNIQUES

Strategic planning and control systems can be defined as a type of management process used to evaluate, analyse, implement and monitor the total programmes and operations of a large scale organisation. Strategic planning generally involves an analysis of the environment in which the organisation is to operate. This would include, for example, capabilities of the organisation itself; the capabil-

GENERAL ELECTRIC'S

HYBRID COMPUTATION SYSTEM



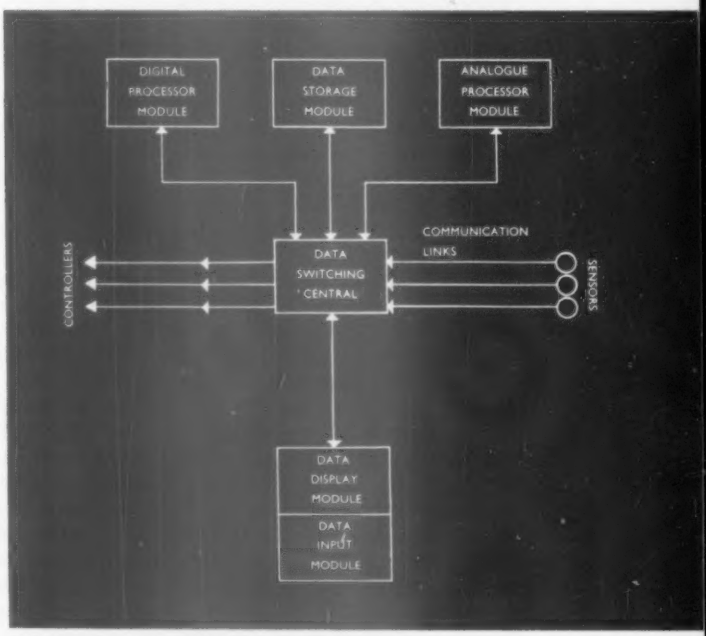
ities and probable plans of competing organisations; and a detailed account of the probable outcome between the organisation and the competition within the environment.

Future strategic planning systems will probably incorporate a technique called 'Operational Gaming'. This is actually a combination of Monte Carlo machine simulation and pre-programmed or human-interposed decision models. In the operational game the simulation represents the environment. Data which define the situation, the competitors, and the organisation in question are entered into the simulation model. Then the simulation is manipulated using Monte Carlo techniques, pre-programmed decisions, and real-time decision models, supplied by human players or by a set of decision models within the machine system. Systems of this kind are already being used on a limited basis in industry.

DYNAMIC INDUSTRIAL PROGRAMMING

At the present time, industrial systems are (with a few exceptions) entirely digital in nature. Analogue models in future industrial systems may be used for matrix analysis and dynamic programming if optimal algorithms for combined (analogue-digital) systems can be developed. The complex arrays of data, the geometric nature of the existing algorithms, *ie.* symbol manipulation systems used to solve mathematical problems, and the need for only an approximation of the optimal solution indicate that the development of combined systems routines may prove to be more efficient than existing digital routines.

It seems, then that combined capabilities of digital and analogue models will probably vary depending on the class of application (*ie.* process control, production control, strategic planning). Future process control systems will have a greater analogue than digital capability, but the digital requirement will increase as systems become more complex. Future production control systems will have a balanced digital and analogue capability. Strategic planning systems will have a greater digital capacity; as the size of systems increases, the analogue element will be strengthened. Certainly the market for combined systems will be stimulated by the eventual development of a more efficient analogue-digital communications 'central', and by generating combined system algorithms for dynamic programming, matrix evaluation, and data analysis.



BASIC ELEMENTS IN A TYPICAL POLY-MODUAL PLANNING AND CONTROL SYSTEM

From the Conference Room

R Murray Paine reports on a BIM conference held at the beginning of last month

O R TODAY

THE brochure for the one-day conference on ' Management Uses of Operational Research ' held at the Connaught Rooms, London, on June 6, stated that ' this conference is *not* intended for Operational Research practitioners'. Organised jointly by the British Institute of Management and the Operational Research Society, the conference was in fact largely intelligible to those for whom it was intended—directors and senior executives who wished to discover whether OR could be of use in their companies, and the day was relatively free of jargon, though those fashionable words ' Monte Carlo ' and ' boundary conditions ' did crop up from time to time.

Launching the conference into safe waters, Mr R J Kerr-Muir, a director of Courtaulds Ltd, insisted that OR was an aid to management—not a substitute for it, and gave his view of OR as providing objectively a quantative assessment of overall business problems. He stressed the point that the problems tackled by the scientific approach of OR were company-wide and cut across departmental divisions—' it helps to decide in which factory to produce what product—not just how to lay out a particular factory or office '. For this reason Mr Kerr-Muir felt that the OR team should report to a high-level, preferably a director in touch with other senior executives.

Two case-studies were then presented, to show the executive what OR could achieve and some of its methods. These studies emphasised that a large part of the job—perhaps 90 percent—lies in collecting the data on which to use mathematical or other models. This collection process was a very tedious affair, akin, it was said, to picking winkles out of their curved shells, none of the supposed glamour of OR here. Mr R H Collcutt, head of the OR department of the British Iron and Steel Research Association (BISRA) in the course of his talk on ' Importing Iron Ore ', revealed that there were over 200 graduates engaged in OR in the steel industry. For the total industry of this country, therefore, the figure of OR workers must be over a thousand.

Mr Collcutt's study showed that in order to speed up and reduce the cost of iron ore imports for the industry as a whole, one should instal a large amount of handling equipment concentrated on one berth in a port. One should not spread the equipment over two or three berths nor operate it at full capacity all round the clock. This finding was not the one that common sense or traditional practices might have indicated. Mr Collcutt also discussed the different results of a similar problem posed by one firm rather than the industry. He felt he could not have carried out his study without the cooperation of line management, and that the best way of presenting the results to management was in the form of a forecast of the probability of what would be the consequences if one action was taken rather than another. In other words OR should suggest several alternatives to management and not push one rigid solution.

FIND THE PROBLEM

Mr A Battersby of British Petroleum spoke on the ' Distribution of Oil Products in Belgium '—in which an original proposal by management to close one overloaded old depot and replace it by a new one, was shown by the OR team not to be the real problem. The real problem was the correct distribution pattern for the complete country via canal, rail and road. This investigation resulted in the recommendation to close five depots and open no new ones, and change to a larger size of barge, with the expectation of a saving of one-third of the total distribution costs. BP have acted on this recommendation and realised great savings—a very good example of how OR can pay. Mr Battersby went on to show the dynamic aspects of business in that the changing transport and political conditions to Belgium could affect the costs of distribution and thus in five years time change the present OR solution.

Both the case studies revealed the advantage of using digital computers to simulate by models the actual situation. But the speakers emphasised that this did not mean a firm had to own a computer, since this type of work was very amenable to hiring time on large computers. Mr Battersby, in very refreshing language, claimed that OR 'was not just for the big boys' and showed that by making certain assumptions and limiting the size of his problem, BP did not need to use a computer for the first phase of the job. In an enlightening aside Mr Battersby also made the point that the normal injunction to an OR worker, at the start of an assignment, 'to identify the decision-maker' meant 'find out where you are going to pass the buck if things go wrong'!

The last formal speaker was Mr D Lamberth of J Lyons and Co Ltd, whose paper was called 'A Challenge to Management'. His approach was the profoundest and most abstract of the day, and he probably did not satisfy the immediate requirements of his audience—to acquire more facts about the techniques of OR. He was concerned with the environment in which a firm existed, and, in a sense, the ethics of its policy and the affect on the OR worker. Mr Lamberth made the point that what management would get out of OR depended on what management wanted or believed possible, and what scope they were prepared to give the OR team. One of his more challenging remarks was: 'In its broadest sense, I suggest that the operational research team is the total of the management in business, led by the general manager.'

WHERE DOES IT FIT IN?

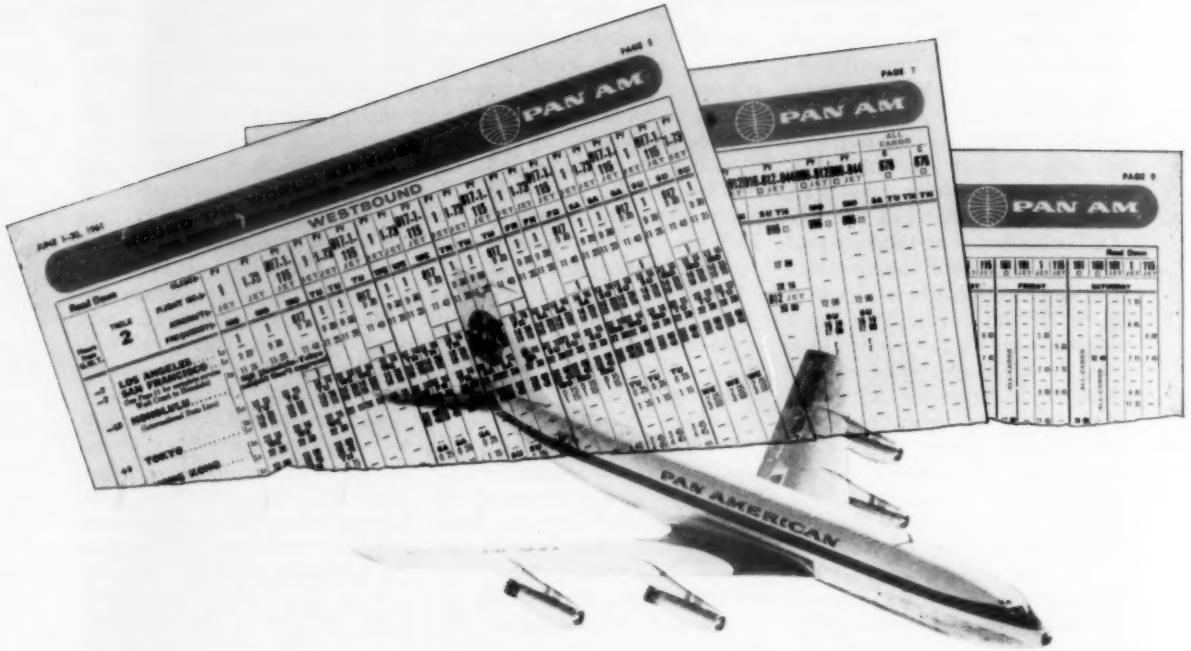
The afternoon of the conference was devoted to discussions in small groups and a final 'brains trust' with Professor R W Revans (Manchester College of Science and Technology), S Beer (United Steel Companies Ltd), R T Eddison (NAFFI) B H P Rivett (Arthur Anderson and Co) and G W Sears (The Shell International Petroleum Co Ltd) on the panel. Many questions and arguments arose, which can be classed under four main heads:

1—What is the place of OR in the management hierarchy?
2—How do you choose staff to set up an OR department?
3—What are its relations with other management services such as organisations and methods, work study, market research and internal audit?
4—Are there any problems with the trade unions in carrying out OR studies?

The first three topics seemed to arise out of the difficulty of defining operational research and saying how it differed from other techniques. The programme offered as a definition of OR: 'the use of scientific methods in the examination of management problems in order to provide management with the best basis upon which to take decisions relating to those problems'. This, of course, could be claimed to define also O and M, and work study activities—the difference possibly being in the type of 'tools' used and the extent to which they affect the whole firm—OR certainly uses more mathematical 'tools' than the other two approaches. The panel, especially Mr Stafford Beer with his gift for dramatically presenting a case, felt that OR should report to the highest level possible, and that OR people should sit on all available committees, talk and lunch with senior management and thus sit in on all strategic discussions as a matter of course. One speaker put it thus: 'If you fit OR at a lower level, you will get a lower level answer.' Some of the body of the hall did not agree with this view and felt that similar claims could or had been made for other services.

It was agreed that there was no reason for a long-term conflict between OR, O and M, and work study, though the preponderance in any firm depended on which was there first and in what strength it had established itself. One arrangement suggested was for a 'management services division', which consisted of all three disciplines and the computer team, which could be mutually helpful and could be called upon to tackle problems in which jointly their individual specialities could provide solutions. But as befits an OR conference the panel felt the OR section should be the senior one, since they were concerned with problems affecting the whole company.

The type of staff working in OR was shown to come from several backgrounds — mathematicians, physicists, engineers, geologists, statisticians, economists—the only common bond being a belief in the scientific method. In discussing how to set up an OR team, the panel suggested it was best to bring in an experienced OR man from outside the firm. This sounds a very good opportunity for existing OR workers and must make their firms anxious about the future. 'Every OR man a manager' would be an extremely useful slogan for recruitment to the profession! There did, however, exist good reasons for this advice, chief among them the difficulty of teaching an existing company executive the OR approach. It was felt that any OR worker should have a stimulating personality and the ability to express lucidly to management the results of his investigations. Young OR workers can be trained and two MSc courses in OR are running at Birmingham University and at Manchester College of Science and Technology. Professor Revans from Manchester made an important point that British companies seemed to be neglecting his course, though he had many students from overseas. He felt this was probably part of the general failure of British management to make sufficient use of the management training offered.



Sell until we tell you

. . . that no more sales can be accepted—is what Pan American Airways say to their world-wide network of agents which sells seats on the airline's numerous flights. This, it emerges, is a key feature in Pan-Am's seat reservation control system.

David Roach Pierson

IN the airline business serving the customer efficiently is probably the key to success. This service can have many facets—fast and comfortable service, the ever-smiling and deferential air hostess, luggage handling, etc.—and all these require considerable behind-the-scenes organisation. One problem that all airlines have is how to keep track of the sales of seats for their various flights, so that no more seats are ever sold than an airliner has available. This is roughly equivalent to the problems of stock control in manufacturing industries, and the more an airline is successful, expands its services, the more critical the problem can become.

Consequently, the news during recent months that at least two international airlines planned to adopt elaborate equipment for checking on seat availability has caused considerable interest. For example, BOAC are to invest more than £100,000 on an electronic seat availability system which comprises a computer which will be able to provide information on flights to agents hundreds of miles away.

Such a system, when it becomes operational, will contrast with the methods employed for doing the same sort of work by the London Reservation Centre of Pan-American Airways, which despite handling a total of 2½ million seat reservations, uses simply a punched card complex, albeit programmed to act like a computer.

The London Reservation Centre is the third biggest Reservation Control unit in Pan-Am, the other two being the Reservation Controls at Idlewild Airport, New York, and San Francisco. London controls a flight 'empire' which extends eastward as far as Hongkong, with intermediate flight stops such as Frankfurt, Ankara, Karachi, Rangoon, etc.; it covers a southward flight routing as far as Johannesburg, with intermediate stops such as Accra and Leopoldville; northward as far as Helsinki; and all the westward flights to New York and San Francisco whether or not they are routed through London. In all it covers some 17,500 flight sectors.

This term 'sector' may call for some clarification. It is in fact the basic unit into which flights are divided. In almost every case a flight is not a direct non-stop passage between two points; there are intermediate boarding/landing points. It is therefore possible for a passenger to fly only the first, or the first two laps of a five lap flight, from Hongkong to Bangkok—on a westboard round the world flight from Hongkong to London, or from London to Frankfurt. The flight between two successive intermediate stops, is known as a flight sector, and all calculations of reservation availability is made on the basis of sector or sectors booking.

The reservation cycle begins in February, with the issuing of the summer schedules. These cover the flights scheduled for the 40 week period between February and November. Details of flights are sent to all the Pan-American selling points—100 selling offices, and several hundred agents—who can commence selling seats on these flights immediately on receipt of the schedules.

The selling offices and agencies have two types of selling facilities or conditions allotted to them. These are worked out in New York on a careful appraisal of seats sold. The two types of selling facilities are 'free sale' and 'sell and report'. These two types are allotted, depending on the volume of sector sales made. Thus it is a remote possibility that a sales office in Helsinki will sell flight space between, let us say, Hongkong and Bangkok. He therefore is given free sale facilities over that, and similar flight sectors, which means he has *carte blanche* to sell and to continue selling. Only a very exceptional demand, such as a rush of evacuating civilians from a trouble spot, would cause the free sale to be withdrawn, and this would require top level sanction from New York.

'SALE AND REPORT'

On the other hand the sales office in Helsinki may do quite a brisk sale for flights between Helsinki and London, or Helsinki and Oslo. On these flights the sales office is given *carte blanche* to 'sell and report'. This means that he must keep schedules of flight sectors open on that flight. He may at any time be sent a note to the effect that Helsinki-Oslo is closed for sale on Flight A, so that passengers must travel on other flights. This instruction may be countermanded later, should cancellations occur on that flight, when the sales office is told that they may carry on selling, since the flight sector is now open for sale.

It has been reckoned that 78 percent of all bookings made will be cancelled and rebooked. This means that the sector flight position may vary from one day to the next. This also means that there must be a flexible maximum and minimum set for flights, on the basis of which flights may be declared open or closed for sale.

It is clear that with so much activity variable margins must be allowed for fluctuation. Accordingly, when a flight scheduled for late August is declared open for sale in February the flight booking ceiling may be put considerably higher than the maximum capacity of the plane.

Thus Pan-Am reservation staff know from experience that the cancellations will take care of the overbookings. As the flight draws near the maximum is progressively lowered, until just before flight day it is practically the actual seat capacity on the plane.

When a flight sector goes over the settled maxi-

mum it is declared closed for sale. It continues to be that way until cancellations cause bookings to fall below a prescribed minimum. When this happens the flight sector is declared open for sale, and bookings can once again be accepted.

There are only two states—open for sale or closed for sale.

The reservation problem can be outlined as follows:
1. 3,500 flights, to be updated daily as flight change information comes in: 2. the maintaining of control over bookings by a 'sector open' or 'closed' technique; 3. the preparing of passenger records on all flights: 4. the preparation of flight manifests—lists of all persons travelling on a particular flight to be printed out and despatched to all flight ports three days before the flight take off.

This was the problem which confronted Derick Coles, the head of the punched card department of Reservations Control. Coles knew what needed to be done, and he had studied computers and the method of exception reporting used. He felt that these methods could be used on a punched card complex.

TAKING EXCEPTIONS

'Basically, I had to maintain the inventory of all the flights and update each sector or sectors as bookings came in. Also I had to keep records of all passengers who booked or cancelled and rebooked. But I discovered that it was not necessary to have a print out of flight details every time there was flight activity. A print out was necessary only when the maximum or minimum figures were exceeded, that is, when a flight that was open for sale topped the maximum set for it or a flight that was closed for sale dropped below its stated minimum. In this case action was required. Within those tolerance bookings could build up quite happily without action needing to be taken.' This was the principle on which Coles set out to design his punched card system.

The flight details are kept on flight summary cards. These cards contain information relating to the flight number, the date of the flight, the day of the week (important since flights are routed differently on different days) the routing of the flight the sectors involved, the bookings per sector and per class—there are two classes of travel on Pan-Am, first class and economy—and the total seats available, and the maximum and minimum figures set for the flight.

This is a considerable amount of alphanumeric information to be kept on the cards, sometimes taking up all 80-columns of the card. To take some of the load a new system has been devised whereby all the routings possible are punched on a separate card known as a routing card. In this way the necessity of having two summary cards, and so taking the speed of reading and tabulating is avoided. The flight summary cards, filed by flight number and date are held in the punched card department in readiness for the daily updating cycle.

Information relating to passengers is held on a passenger card or detail card. This is prepared from information received over the teleprinter system of bookings made. The passenger detail card contains such information as the name of the passenger (or names since a family of five can be accommodated on the one flight card) the number of persons travelling, the type of transaction (whether a sale or cancellation, or certain other sale categories) the point of embarkation and destination, the flight number and date, and special information such as Hindu food required, etc.

Teleprinter messages relating to flight bookings are received from the teleprinter room. The staff in the Punched Card Department interpret the codes and punch the passenger cards relating to these transactions. Four IBM automatic key punches are provided for the punching operation.

The cards when punched are merged with the punched cards prepared for the American reservations which are punched in New York and flown over by jet service. The card proving operation is carried on a special card proving machine, the IBM 108, a machine of great versatility which operates at 1,000 cards per minute and can serve in addition as a sorter and collator. The cards are proved *ie.* errors in punching where alphanumeric punching appears in numeric columns, and errors of content, that is to say errors in date, and the entering of more than five passengers on one detail card are detected. The date is a frequent source of error since agents tend to put the date that the flight starts from their embarkation point, which may be a day or more later than the date the flight started from London or wherever its point of origin was.

THE DAILY UPDATING RUN—MERGING THE CARDS

The summary cards are now taken and matched with the passenger cards. (They have previously undergone a status updating run on the tabulator, but this can better be explained later). The passenger cards in random order are put on the input hopper, followed by the flight summary cards. They are then sorted by flight, and date, in some seven passes on the 108. As a result of this sorting run, the summary cards for which no action is required are segregated and can be filed away: the remaining cards are filed in flight and date order, with the summary card heading the appropriate passenger detail cards. They are then ready to be put on the punched card tabulator.

The tabulator is a specially designed IBM 421 Accounting Machine. It has a store for alpha-

betical data and counters for numeric data. The counters and selectors have been specially designed and wired by IBM to ' Coles ' specifications. The tabulator works on the dual cycle principle, first the cards are read and the information stored; next, card reading stops and the program for handling the information, card punching, print out, etc. is begun.

The routing information is read into the store from the summary card, and the status information regarding each of the sectors is read into the counters of the tabulator. The passenger card is next read and the routing on the card is checked against the flight routing from the store. If the two do not tally, a No-ops print out is made on the tabulator. If the routing is in order, a check is made on the status of the flight *ie.* whether open or closed for sale. Of course, if the flight activity on the passenger is a cancellation it is not necessary to check for status, the appropriate counter(s) representing that sector(s) affected is automatically updated. This automatic updating also applies when a passenger has re-confirmed a booking for which there is no record in the inventory. If he has the valid ticket to prove it, his booking must be accepted regardless of the status of the flight.

For other types of sale, however, updating can only take place if the interrogation has cleared the sectors as being open for sale. Each flight sector has its own counter and each class of flight has several sectors, so that as many as 18 counters may have to be simultaneously interrogated and updated. If any sector is closed this is shown by a print out.

THE PROGRAM RUN

This procedure is repeated as the next passenger card relating to the flight is read and continues until the next flight summary card is read. That is the signal for the tabulator to go into its program *ie.* to stop reading and perform calculations, print out etc. on the information which it has read. The first stage of the program is clear the counters and store and punch this updated information via a 519 summary punch geared to the 421 tabulator, into a new summary card. This updated summary card (or cards since they are accumulated until the end of the run) is later merged with the other summary cards on which there has been no flight activity that day.

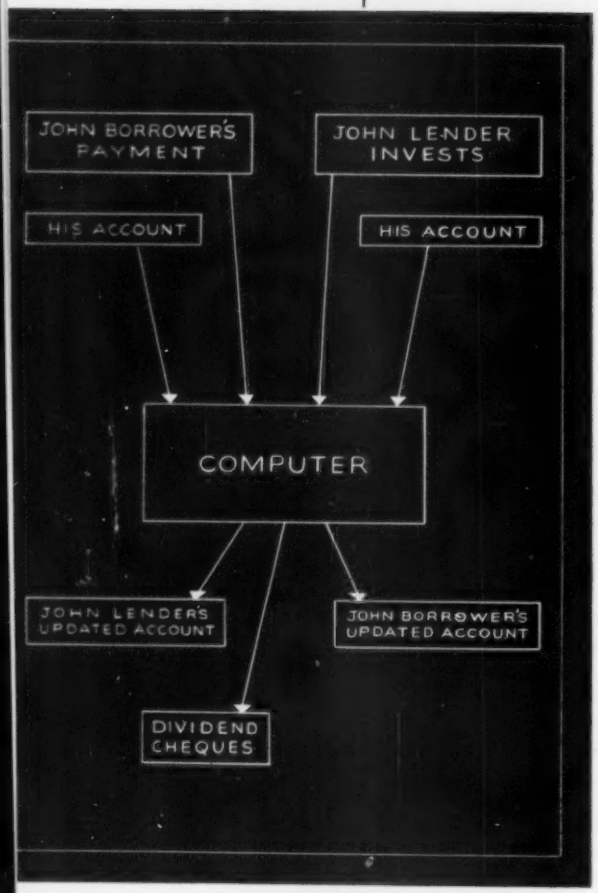
The updated totals are now compared with the maximum figure supposing the flight is open—and with the minimum figure—suppose the flight is closed. This is done by inhibiting the selectors from interrogating the counter in the appropriate condition *ie.* only maximum figures for open, only minimum figures for closed. In the event of there being a status change, on any of the flight sectors, the entire flight details relating to that flight will be printed out. In this way the full state of bookings on each sector of the flight—in both classes—will be shown, though only one sector may be affected by the sale. The controller can then take instant action authorising the sales offices to begin or stop selling on a particular flight or flight sector.

There is one last check programmed on the tabulator. This is the check for abnormal activity. If bookings suddenly begin to build up with apparent reason, this could be the beginning of a big Congo-like evacuation. This can give warning of this so that first the maximum-minimum figures can be adjusted on the controlled flights, and later if the trend continued, application can be made—or action taken, if this is an emergency—to withdraw free sale facilities from a particular point.

At the end of the tabulating run, the sheets relating to the condition change of flights are passed to the Reservations Control Managers, John Berry. They will authorise acceptance or rejection to be sent over the teleprinter line to sales agents. They will also determine whether in view of the maximum/minimum figures being attained, the flight shall be declared open or closed for sale. This is a human, not a machine decision. If change of status is decided on these flights the sales offices and agents operating under sale and report will be notified. Then change of status cards will be prepared for that particular flight. In a special run the summary cards will be updated by status and fresh summary cards prepared on the 519 summary punch. This updating by status is usually the first run of the day.

Following the main updating run the passenger and flight summary cards would be sorted and refiled. The passenger cards together with the old summary cards would be put on the 108 card proving machine and the summary cards extracted. The passenger detail cards would then be filed in flight order until two days before the flights. Then they would be taken out and run through a card-to-tape punch to prepare the flight manifests or ' booking lists ' relating to each flight. The tape is then sent over the teleprinters to the various boarding and landing points on the route, where it can be re-converted to the printed flight manifest form.

Derick Coles, who did the programming for the whole job, and drew up the specification for the 421—and for the larger 407 tabulator which is later to replace it, when accommodation becomes available—looks forward to the day when his work can be done on a small computer. ' I'd rather program a computer any day. No complications with wiring programs. No mechanical parts—as opposed to electronic—to give trouble '. He intends to utilise his computer—if he gets one—on the same lines as he has designed his punched card system. ' I know what I want ' he says ' And I get the machine—or modify the machine—to do it. That is the only way to get the best out of a data processing.'



Blueprint for Computer Operations

How a computer might be put to work on the problems of a building society

by Robert McKinnon

THE news that Leicester Permanent Building Society are to computerise their operations is of course important in itself, but it will also be interesting to note if any comparable societies follow Leicester's lead. Already in this series we have discussed why to date none of even the large societies with centralised accounting systems has gone over to a computer. The two main reasons given were that the societies were satisfied with the existing system of accounting and they were convinced that a computerised system would cost more than it was worth.

Despite all the excellent reasons for preserving the *status quo*, it seems likely that a number of societies will eventually tread Leicester Permanent's footsteps. Land prices may be rocketing, but the demand for houses still far exceeds the supply and, even in the event of land itself being nationalised, the demand for houses would of course continue: in fact, the effective demand would probably grow. So far as building societies are concerned, all the indications point to steadily increasing business.

At the same time, societies are likely to find it more and more difficult to attract suitable staff; a number of them, especially in their town branches, are already experiencing this. Nowadays, young people with a good secondary education do not have to sacrifice interest in order to obtain security, and as a result many of the traditionally secure activities such as banking, insurance, building societies and even the Civil Service are losing their appeal.

Taking a long-term view of the problem, then, computer installations or, for smaller societies, punched card installations seem to be the logical answer. Such systems can be operated by a fraction of the manpower required by existing methods of accounting, and at the same time the work is more interesting, more challenging and better paid. Again, the national bias against things technological is slowly being dispersed. This is not to imply that business firms will start buying computers to keep up with the Joneses, but it may well mean a much more objective approach to the merits of machinery.

How, then, would a large building society set about using a computer? Systems would of course vary in detail according to the type of installation and the amount of information demanded of it, but all such systems would imply that the accounting was done on a centralised basis. The first thing to be considered therefore is the best and quickest method of recording information from branch offices in a form acceptable to the computer.

This could be done in a number of different ways: mark sensing, teleprinter service with paper tape input, punching paper tape at branch level using an adding/listing machine, punching cards at the branch or punching cards centrally. Probably the cheapest and best method, especially as in building society work there is no need to send details of branch transactions to the central accounting department the moment they are carried out, is to have a small hand punch at each branch and punch the cards as movements occur. The main advantage of this method is that, should any query arise, the counter clerk is on hand to rectify the error. Further, the cards can be punched in the correct manner for computer input and are ready for immediate processing when they arrive at the computer centre.

A teleprinter network between head office and all the branches would be better still. Tapes could be prepared off-line by normal keyboard operation and sent over the network. However, there may not be enough daily traffic from every branch to make such a network an economic proposition. Apart from the cost of the equipment and of renting lines from the GPO, there would have to be a trained teleprinter operator at each branch. Most business teleprinter networks have been installed primarily to speed up the flow of information. With a building society, this is not necessarily a problem.

At head office all records would be kept on a main ledger tape and would be in the sequence of full account details within each department within each branch. Each morning the computer's first job would therefore be to accept cards from each branch (these would be in random order) and sort their details into the sequence of the main tape and at the same time print a control tabulation for checking purposes.

To avoid the daily through-put of *all* account data, two tapes could be kept. One of these could contain the balances only of all accounts and the other the full history of the year to date.

The tape produced from the daily sorting run would be used to update the weekly cumulative balance tape. At the same time a cumulative weekly tabulation would be printed giving the new balance position for each moved account. The tabulation would be divided up and sent to the relevant branches; among other things, it would give details of the last movement to take place on a given account within the current month. In this way the staff at the branches could investigate queries which may have occurred since the production of the last month's ledger.

The weekly tape would of course be run against the main tape to update all transactions occurring within the week in question. An arrears tabulation

would be produced simultaneously and sent out to the branches for further action. Each month, after the fourth week's updating run, the main tape would be run through and monthly ledgers produced for each department of each branch. On receiving these new ledgers, the branches could destroy their daily lists for the month and retain only those for the next month as they arrive.

Interest would be calculated as each movement takes place. At each half-year, interest warrants could be printed for investors' accounts using the information on the main tape, or the interest could be compounded with the capital invested. For mortgage accounts, a print-out at the end of each year would produce the mortgagees' annual statements.

In order to spread the above operations, the branches could be divided into groups, and the work of each group processed on various dates. There would of course be the usual checks to see that the figures coming from and going out to the branches were in fact correct.

The computer would still have excess capacity, but it could do the society's payroll and furnish special financial information to management. This second function, however, does not seem to present any problem even at the present time. None of the societies questioned said they had any difficulty in providing at short notice financial facts and figures to their directors.

In the case of Leicester Permanent, one or two of the operations described will be simplified because of the special ' random access ' filing system in the NCR 315, the computer they have ordered from the National Cash Register Co.

The machine, to be located at Leicester, will take over the whole of the society's mortgage and investment records, together with such ancillary jobs as staff salary accounting.

Mortgage and investment records will be stored invisibly on special magnetic cards, held in easily-loaded cartridges. Each cartridge will contain over five million alpha-numeric characters of information, representing the names and addresses of many thousands of borrowers or investors, plus details of all transactions during the current accounting period.

The main advantage of this ' random access ' filing system is that the computer can locate any item in a fraction of a second. Thus the Leicester Permanent will be able to process branch transactions in random order immediately the details are received at the computing centre. There will be no need to sort the input data into serial order.

The new system will also provide an extremely fast and economical means of dealing with enquiries. Changing cartridges takes only 30 seconds and consequently the whole of the Leicester Permanent records will be constantly available for reference.

Because the information stored on the magnetic cards can be up-dated over and over again, each cartridge will provide a perpetual file, the contents of which will be printed out only at the end of each accounting period. This will practically eliminate the use of conventional documents.

Details of branch transactions will be processed daily, after they have been punched into paper tape by automatic punches coupled to National adding machines. The adding machines will simultaneously list the transactions and produce totals for reconciliation with branch records and the accounting summaries regularly compiled by the computer.

Information is fed to the 315 central processor in the form of punched paper tape or punched cards. NCR have developed a punched card reader which operates at speeds of up to 2,000 cards per minute, and there is an alternative unit operating at 400 cards per minute. The paper tape input speed is 1,000 characters per second.

Dividend warrants and annual mortgage statements will be produced automatically by a high-speed printer which forms part of the 315 system. This will operate at 600 lines per minute, equalling the output of at least 200 copy-typists. Reports on exceptional items will be produced by automatic typewriters during the daily processing runs.

During recent years, Leicester Permanent have grown rapidly, and the new automatic bookkeeping system is designed to accommodate very substantial increases in the volume of work.

The 315 has been designed to accept programs written in COBOL, the new common language for computers. This means that programming can be done swiftly and economically by office workers with no training in mathematical logic.

In querying whether this move by Leicester is the first breeze in a wind of change, we come back, as it were, to where we came in. The building society industry attracts funds by projecting an image of security and massive respectability, and among such institutions there is rarely a strongly developed appetite for innovation. But building societies are no fools when it comes to running a business, and it is a pound to an old punched card that when a computer indicates economies and improved efficiency, that computer will be ordered. It is equally certain that any computer installed will work for its living.

It may well be that other large societies will wait until results start flowing from the Leicester installation before they move themselves. In the long run, however, it seems likely that the pressure of events will leave them no choice but to follow suit. Besides, they will have the benefit of much better hardware than the pioneer users of computers, and they will have learned a lot from those who blazed this particular trail.

Punched Card Systems

THE punched card system is the oldest and best known of all data processing methods. The punched card, devised by the French mill owner Jacquard in the 18th century as a first step in automating weaving spindles, was first developed for data processing work by Hermann Hollerith in 1886 for computing the US census of that year. Since then families of equipment have been developed around the punched card, and each decade of this century has seen modifications and improvements in punched card equipment. There are reckoned to be about 4,000 punched card installations in Britain, though, since their age can be from 50 years downwards, a wide variety of models are in use. Some equipment, though still used regularly, can be considered 'semi-obsolete', and in this survey we are mostly concerned with those families of equipment which manufacturers have in active production.

The principle behind punched card systems is simple: information is converted into a code which can be reproduced as a pattern of holes punched into a standard manilla card. This card is so designed and printed as to have columns (or fields, as they are usually called) to which specific information can be assigned—for example the publication date of this issue of AUTOMATIC DATA PROCESSING would be recorded on a card in the following way: '9' would go into one column, 'JUL' would go into the next three, '1961' in the next four. The columns contain the figures one to nine, and three other column places, assigned to 10 and 11 if sterling amounts are used, can be used for alphabetic punching, etc. The number of columns on a card vary with different types of systems, though it is likely that in future 80 columns will become standard. Systems exist at present which work with 21-, 36-, 40-, and 65-column cards, though some of these are almost obsolete. In the USA there are systems which use 90- and 45-column cards, but these have never been used in Britain. (It should be noted in passing that the 21-column card has only 11 punching positions per column.)

When information has been punched into cards, cards can be sorted on the punched holes into any desired sequence by machine. Numbers in the cards can be added, subtracted and even multiplied, and the results printed out on continuous stationery by tabulators.

Punched card systems are basically electromechanical in conception, though technological developments have cleared the way for electronic punched card equipment.

Although a number of firms have designed equipment which produce punched cards as a by-product of accounting and other operations, the manufacture of punched card systems as such is confined to three large firms. These are International Computers and Tabulators Ltd (formed from a merger of two pioneers of punched card systems, the British Tabulating Machine Co and Powers-Samas), De La Rue Bull Machines Ltd (the British associate company of the Compagnie des Machines Bull of France), the IBM United Kingdom Ltd (part of the IBM World Trade Corporation).

Working with punched cards normally means following a sequence of operations, each operation being performed by a distinctive machine, and these operations can be categorised:

1—Punching cards, and verifying by a second punching operation that they have been correctly punched.
2—Interpreting cards so that coded information is printed out in clear.
3—Reproducing cards, which can be done in a number of ways.
4—Sorting and collating cards.
5—Totalling, calculating and printing out results.
6—Punching out the results of additions and calculations in summary cards.

PUNCHING AND VERIFYING

Punching cards may be done as a wholly manual operation using a hand punch, or a machine-assisted manual operation, using an automatic key punch. In the wholly manual operation, which requires no power supply to operate equipment, blank cards are placed by hand on the punching track in a movable carriage. Each of the columns in the cards are aligned successively under the punching head, the column in the punching

position being indicated by a pointer moving across a guide card.

Punching is carried out by the operator depressing appropriate keys, located on the right side of the punching head, for easy one-handed action. Speed of punching will vary with each operator, but will normally be of the order of three to five digits a second. Hand punches of this kind are of limited use: they are principally used for reproducing small quantities of cards, and are too slow to be economic for punching large quantities of cards.

Hand punches available on the market include:

The De La Rue Bull P 80: this handles 80-column cards; punches rectangular holes with a speed of handling of three to five digits per second; it features a 14-key keyboard.

The De La Rue Bull Vor-relay punch: similar to the P 80, but electrically-operated, so punching is 'power-assisted' and cards are moved as the keyboard is struck: more efficient because less tiring for operator; suitable for continuous work where input-output not necessary; can be supplied with typewriter-style keyboard. (This model is known as the *Porod*.)

ICT handfeed key punch: has 15 keys and handles 80-column cards; speed of handling is three to five digits per second; tabular rack guide similar to typewriter tab stops directs movement of card; primary or secondary stops arrest card at column where punching is required to start; skipping columns is done by tabular inserts, activated by the skip key on the keyboard.

ICT hand feed punch 2: this is for punching 38-column cards; specifications are similar to ICT handfeed punch 1.

ICT Powers-Samas hand punches: there are two models —one for 65-column and one for 80-column cards; they punch round holes and handle cards at the rate of three to five seconds; the skip key operates in conjunction with the detachable skip bar; the position of the carriage in relation to the card's columns is indicated by a pointer, which moves along the numbered column indicator; alphabetic punching by depressing two keys according to punching codes; interstage punching (*ie.* punching between the columns to give double column capacity) is possible with this machine.

ICT Powers-Forty punch: same specifications as for the Powers punches mentioned above, save that card capacity is 40 columns.

ICT Powers-One punch: same specifications as for other Powers punches save that card capacity is 21 columns.

Corresponding to each type of hand punch there are small hand verifiers, which provide a check on the accuracy of data punched into cards. Verifying is usually done immediately after cards have been punched, by a second operator. This operator works exactly as the first operator, depressing keys which cause plungers —one for each punch position—to drop onto the surface of the card; if the punching is correct an electrical control connecting the positions with the card rack operates, and the card is moved one column; if there is an error there is no such contact, and the rack stops. The verifier has all the stops and tabular inserts to enable it to correspond to the hand punch which it serves.

There are six types of hand verifier which correspond to the hand punches mentioned above. These are the *De La Rue Bull V 80*, the same company's *Vor relay verifier*, the *ICT hand verifiers 103 and 104*, and three *ICT Powers-Samas hand verifiers*.

A feature of several verifiers is the ability to mark cards in ink after verifying them.

Though 'ready repairs', repunching odd cards or small quantities, can be carried out by the wholly manual punch, this method cannot be deemed a practical proposition for normal card punching. The normal method is to utilise an automatic key punch, which has automatic entry and ejection facilities. The blank cards are loaded to a hopper and as each is ejected out from beneath the punching head, the next is fed in. Where individual cards have to be fed in for correction, this will be done manually. A feature of certain automatic systems is that certain functions such as skipping columns, automatic duplication of certain information, changing from alphabetic or numeric punching, can be automatically carried out by means of a program; fixed information required for a batch of cards can also be stored and reproduced with each card. Dual-purpose cards can also be punched, this requiring a high degree of visibility for the operator.

There are nine automatic card punches currently on the market: the Bull Pelerod, Peler (a numerical-only machine), and Bull Pelerod NC (with controlled storage); the IBM 024 and 026 card punches; and the ICT 29, 30, and 31 (80-column) automatic punches; ICT also have in production the Universal Automatic Key punch (40-columns) and the Universal One, a 21-column punching machine.

The Bull Pelerod:
Works with: 80-column cards
Feed hopper capacity: 400 cards
Keyboard: two fixed keyboards, one typewriter, one 14-key numerical. Skipping is carried out by pre-setting tabulation points; gang punching on constant information is carried out by means of a master card synchronised to pass backwards and forwards on a special track behind the normal one. Information is punched into detail cards automatically at 12-columns per second. Features also a reversing device to restore cards to original order in ejection pocket ready for verification.

Bull Peler: For numerical information only. Single fixed numerical keyboard.

Bull Pelerod with controlled storage: As the Pelerod but with a memory storage capable of holding 20–30 card columns, containing up to 46 combinations, alphabetic, numeric or code symbols. This facility allows the operator to store, remove or replace constants from master card as required; machine storage activated by a change-over switch; all stored constants are suspended

on the occurrence of special punching in master card, when changeover switch positioned for 'semi-automatic' action.

The IBM 024 Card Punch
Works with: 80-column cards
Feed hopper capacity: 500 cards
Keyboard: cable connected so may be moved up and down desk surface of the punch as required by operator.

It may be either an alphanumerical typewriter-type keyboard (with either three or 11 special characters), or a numeric-only keyboard. The alphanumeric keyboard will punch either alphabetic or numeric characters depending on the position of the shift key; this key operated in conjunction with a program drum which controls the operation. Functional keys on the keyboard relate to alphabetic and numeric shift, duplication of the field for which the key is depressed (at the rate of 20 columns per second), skipping, release, feed, and multiple punching. Switches relate to automatic skipping and duplicating.

For skipping and duplicating common information from previous card, punching and the alphanumeric shift are controlled by a program card which is specially punched and inserted on a program drum. Each row on the program card serves a specific purpose in this respect.

Constant information is punched on to cards by means of a punching/reading method. Under the control of the program card certain information is defined for duplication in successive cards. After the initial punching, the punched card passes under a reading head, in synchronisation with the next blank card which passes under the punching head, and is read column by column as the second card is punched; as each constant passes under the reader it is sensed, and simultaneously punched into the following card.

The punch also features full visibility for punching dual purpose cards; back spacing, a self checking device for numbers; an auxiliary duplicating device for constant information; a decimal tabulation feature; and a facility for an alternative program to be run simultaneously, to distinguish between different card designs.

The IBM 026 Printing Card Punch

This machine corresponds to the 024, but has certain extra features, notably zero suppression, and character printing. This means in effect that the machine acts as its own interpreter, printing out above the column punched and allowing full interpretation. A print suppression feature enables printing to be controlled by the program card, so that only required information will be printed.

The ICT 29, 30, and 31 Automatic Punches
Works with: 80-column cards
Input Hopper capacity: 400 cards
Keyboard: either a typewriter-style alphabetic or a numeric keyboard can be cable connected to the machine, or both—a special socket connection enables keyboards to be interchanged; the cable connection enables the keyboard(s) to be moved along the working desk top to suit the operator's convenience.

Skipping, controlled spacing and gang punching over any number of columns controlled by pointed changeable plugboard panels.

There is no facility for reproducing constant information on the 29. The type 30 punch does, however, incorporate gang punching, by means of the control panel.

The Type 31, a development of the Type 29 and 30, has the additional facility of storing the information on the keyboard until released by the operator. The depressed keys thus give the operator the ability to check information before punching. In addition these models have all complete card visibility to facilitate punching dual-purpose cards. A 5-digit counter which counts the cards passing through the machine and a card control for repeat punching are also available.

The ICT Universal Card Punch
Works with: 40 column cards
Keyboard: a fixed machine 14-key-keyboard. Alphabetic punching is carried out by utilising a single 2-key punching code: this also has the 'setting up' feature of other models, *ie.* the depressing of the keys does not initiate punching until a punch switch is depressed.

If information is keyed into the keyboard once, it can be repeated throughout a batch of cards, at the same time as variable information is punched in.

Other features are: visibility for punching dual-purpose cards; automatic carriage return, repeat punching; conversion to automatic verification by turn of a knob; card count control—repeat punching of any number of cards up to one hundred by means of dual control; and card numbering device—for printing 10-digit numbers on underside of a card during punching.

ICT Powers-one Automatic Key Punch: As the Powers-Forty, but punching for 21-column cards.

Verifying Automatically

The verifying operation usually is done by a second operator repunching the data on a machine similar to the punch. This is done either by punching a second hole—as in the case of the ICT Powers-Samas verifiers—which thereby converts the original hole into an oval hole; reading is then carried out and any cards which have no oval holes—or only round ones—are designated by a blank coloured card being fed into the pack. Alternatively the operator punches the data a second time, and the machine checks the two punches, printing in the case of Bull machines a symbol to signify the correct punching or the type of punching, *ie.* single or multiple. In the event of incorrect punching the machine stops and a special symbol is printed over the erroneous column. In the case of IBM machines, the correct cards are notched at the right hand edge, while incorrect cards

are notched against the erroneous column. The ICT 129—corresponding to the 029 signifies error by stopping and displaying a red light, and correct punching by notching a ' v ' in the card.

There are the following verifiers: De La Rue Bull Vinod—the counterpart of the Pelerod; De La Rue Bull Vin—the counterpart of the Peler; the IBM 056 verifier—the counterpart of the 024 card punch; the ICT 129 verifier; the counterpart of the 29 punch; the Powers-40 verifier—the counterpart of the 40 punch; the Powers-One verifier—the counterpart of the Powers-one punch.

SORTING THE CARDS

In basic punched card installations the verified cards would be placed on a sorter and sorted into the alphabetic or numeric sequences required for tabulation.

In the more sophisticated systems the cards may be reproduced and interpreted prior to sorting; but these are requirements which are not integral to the punched card system. Sorting is carried out either electro-mechanically—by using a sorter equipped with metal brushes which penetrate the cards via the punched holes to complete electrical circuits which activate the sorting mechanism—or electronically when the cards are sensed photoelectrically. With the latter method more than one hole can be sensed at a time, thereby considerably increasing the speed of sorting.

There are seven models of sorters currently being manufactured; the Bull Type D 1 electro-mechanical sorter; the Bull Type D 3 electronic sorter; the IBM 083 electro-mechanical sorter and the IBM 084 electronic sorter; the ICT (Powers) 40-column electro-mechanical sorter, the ICT 302 electron-mechanical sorter and the ICT 309 high speed sorter.

The Bull Type D 1 sorter
Input hopper capacity: 800 cards (cards may be fed in while sorting is in progress.
Speed of sorting: 700 cards per minute
Number of sorting pockets: 14
Features: No rigid connection between component units (user chooses punching combination to determine into which pocket the card will go); any reception pockets opened by selecting particular punch combination; regroup sorts performed without operator action; alphabetic sorting devices save the major part of time required for second pass and pack does not have to be reformed after the first pass.

Up to 16 counters can be fitted to the machine and assigned to any perforation; counting is carried out independently during any type of sort.

ICT (Powers) 40-column sorter:
Sorting speed: 650 40-column cards per hour
Sorting is electro-mechanical (one column at a time).
Features: Infeeding of cards into hopper possible while sorting is in progress; automatic stop when infeed hopper exhausted; full counting attachment for cards in each stacker, also for providing totals of batch sorted, plus grand totals; sub and grand counting attachment proving count of each batch of cards sorted, and grand total of cards passing through machine; and shutter delay mechanism for matching up master cards and detail cards.

ICT 302 sorter
Sorting speeds: 250 (for small quantities of sorting) up to 400 cards per minute
Method of sorting is brush sorting (on one hole at a time).
Features: Selection of 12 pockets, corresponding to 12 positions on a column; 13th pocket for rejects; sorter brush set manually on column required. Card counters are linked to each pocket, and also counters for accumulating sub-totals, grand totals.

The ICT 309 is similar to the 302 but with a machine speed of 600 cards per minute. Able to cope with selection, extraction and removal of cards.

Bull D 3 Sorter:
Sorting method: electronic sensing.
Features: This operates at the same speed as the Bull D 1 (700 cards per minute) but has a self-checking device whereby by double reading and comparison, the sorter can check the sort it has just performed; comparison devices allow a single pass to select up to eleven items of alphabetic or numeric information. A special device known as the ' P card ' allows selection by variable pre-coding.

The IBM 083 sorter:
Hopper capacity: 1,200 cards
Speed: 1,000 cards per minute
Sorting of method is brush sensing
Features: a sort selection switch selects up to five categories of sorting; simplified alphabetic sorting; an edit device to reject error cards without stopping machine; 12-sort suppression keys.

IBM 084:
Input hopper capacity: (With file feed) 3,600 cards
Speed of sorting: 2,000 cards per hour
Sorting method is electronic (photo-electric sensing)
Features: Vacuum feeding: 12-sort suppression switches
Special sorting for alphabetic information which eliminates a second run for some cards; sort selection switch can be positioned for double punch, blank column and error detection; radial stackers which can be cleared during use without stopping machine, have a capacity of 1,650 cards.

Part VIII of the Survey will be continued next month when the remaining punched card devices will be reviewed

WHAT'S NEW in systems, services and equipment

New Bank Automation System

Shortly to be introduced in this country (negotiations are currently being tied up in the USA) is the Burroughs 270 Bank Automation System. This system, comprising a central processor, card reader, reader sorter, tape lister, and tape unit, can be used for deposit analysis and account reconciliation as well as automatic proof and transit operations.

Input to this system is through a 1 122 photo-electric card reader and a B102 sorter-reader. The B122, which has an immediate access clutch, reads cards on line to the processor at a speed of 200 cards per minute. The reader-sorter which can operate either on-line under control of the processor or off-line as a high speed digital sorter, reads MICR coded information and sorts paper documents, cheques, etc, at a speed of up to 1,560 documents per minute. An optical scanner is provided for batch form detection. The central processor is in effect a digital computer with a magnetic core storage of 4,800 individual address positions, and a three-address command program stored internally in the computer. It is a solid state, fully transistorised equipment.

For output the multiple tape lister (or listers, since the equipment can be expanded to take a second printer) prints out up to six listings, independently controlled and spaced—at a speed of 1,600 words per minute. The listings can be programmed to correspond to the appropriate pockets of the sorter-reader. Provision is made for 22 positions of printing at 10 characters per horizontal inch and six lines per vertical inch; 10 numerals, 10 specific alphabetical characters and 4 special symbols. The tape lister, which is completely buffered, operates on line.

A secondary output is provided by the B241 tape unit (or units, since up to six can be accommodated in the system). This output is particularly useful since magnetic tape produced at this stage may later be processed on a computer. This unit has a start/stop time of 5 milli-seconds, with a read/write speed of 41,600 characters per second. Longitudinal and vertical parity checking is allowed for by the dual gap read/write heads.

For further details tick GO1 on the reader enquiry coupon on page 43, or write to:

Burroughs Adding Machines Ltd,
Avon House,
365 Oxford Street,
London, W1.

Speedy Lightweight

A HIGH speed printing calculator with—so claim the makers, Oerlikon of Zürich—the highest figure capacity of any comparable machine, is being marketed by Muldivo. The calculator, the Ultra 804, a lightweight machine no larger than an add-listing machine, has a 10 key keyboard input, which activates a rotary calculating mechanism operating at 800 rpm.

The calculator incorporates a full capacity accumulating register for automatically accumulating successive products, and a register for storing constant figures. The multiplying capacity is given as 10 digits by 7 digits by 15 digits, and division capacity of 12 digits by 10 digits. The product accumulator can cope with any number of positive and negative products, each product being independently calculated and printed out.

The automatic transfer feature makes it possible not only to multiply sums directly and also to carry out repeat multiplications. The constant factor need be entered only once to be multiplied by a succession of different values. All negative figures are shown as true numbers and carry the negative sign. A patented interlock system ensures correct operating sequence and prevents the entering capacity from being exceeded.

The machine can serve not only as a calculator but also as an add-lister; it has a listing capacity of 10 digits and a total capacity of 15 digits.

Cost of the Ultra 804 is given as £304, and delivery is ex-stock.

For further details tick GO2 on the reader enquiry form on page 43, or write to:
The Muldivo Calculating Co Ltd,
Dorset House,
Salisbury Square,
Fleet Street,
London, EC4.

Improved verifying device

TWO new models of established tape verifying equipment are announced by Creed. The improved 90 verifier (model S4136 multi-wire keyboard—replacing Model 91 keyboard; 92 tape reader and 25 tape punch) is now able to handle 5-, 6-, and 7-channel tape. Formerly it could only handle 5-channel tape. The speed of verification is appreciably the same as before—15 codes read and verified per minute.

Incorporating the new 90 verifier, but with a Model 75 teleprinter instead of a 25 tape punch, is the new model verifier reproducer, which allows tape editing, tape interpreting, page printing to be carried out as an integral part of the verifying operation. The new model verifier reproducer incorporates several improved features, notably the inclusion of warning lamps to indicate parity or disparity of characters verified, and a tape skip feature which allows the operator on depressing a key to pass over redundant data. Formerly this had to be done by the rather cumbersome inching process.

Will handle 5-,6-,7-channel tapes

Both the new models are in full production, and cost—for the verifier—£513–£663 (depending on tape codes required), and for the verifier reproducer £1,200.

For further information tick GO3 on the reader enquiry coupon on page 43 or write to:
Creed and Co,
Telegraph House,
Croydon,
Surrey.

Updating punched ledger cards

AN equipment fairly widely used on the Continent though only just being introduced in this country by De La Rue Bull, is the Posting Interpreter.

The posting interpreter allows account details to be held on an 80-column card in both plain language and punched form, and updated on a periodic basis. The card is able to accommodate up to 19 lines of printing using both sides of the card. Selected fields of the card can be arranged for punching.

Basically the equipment comprises two card tracks, one for reading and one for interpreting and printing; other devices allow comparison of cards, selection of card fields for reading and printing; and the selection of the line for printing the account details. Optional features include a relay memory unit so that information on a heading card can be printed on each card of a batch, and an addition/subtraction unit which allows items to be posted without the need to punch the sum total into the card.

The operation of the posting interpreter could be as follows: the account cards are made up and punched with appropriate account number. The posting cards prepared as a by-product of some earlier tabulation or sales recording—the combined typing and card punching of an invoice, etc, are entered on the reading track of the interpreter. The account cards are entered on the second track. The cards on the first track are read at one of the two reading stations, a selection device choosing which fields are to be read. Simultaneously the account numbers punched on the account cards are read on the second track, and a comparison is made through the comparison device between the account numbers of the cards on each track. If the numbers agree posting can proceed. The information read from the card on the first track is interpreted and printed on the account card via a printing block of 80 wheels. The selection device chooses the card field to be printed, and the line selector ensures that the information is printed on the line following the previous line of printing. The account card remains in the second track until the account number no longer coincides with that of the posting card in the first track, when it is ejected. Each of the two tracks leads to two receiving hoppers which allow each of the card packs used to be split into two sets.

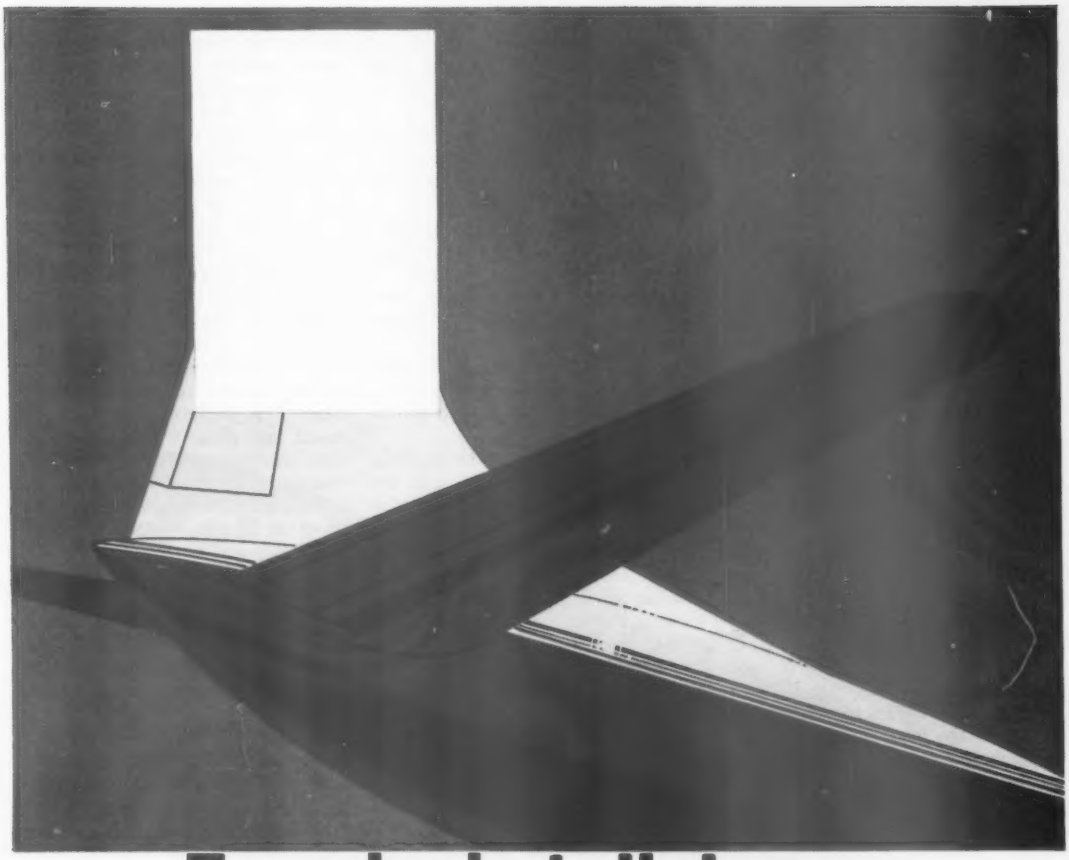
Works in plain language and code

The speed of operation of the posting interpreter is 65 cards (or 65 card entries) per minute.

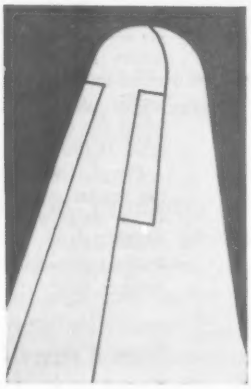
The makers suggest that it can be used for wages posting (weekly, fortnightly or monthly) for the monthly posting of family allowance benefits, and for the annual posting of insurance premiums. It can also be used, simply as an interpreter for the preparation of issue vouchers for stock and for receipts.

For further details tick GO4 on the reader enquiry coupon on page 43, or write to:
De La Rue Bull Machines Ltd,
114/118 Southampton Row,
London, WC1.

continued on page 40



Tuesday's tailplane



There is no doubt that the tailplane will be there on Tuesday– or that every other part and sub-assembly will be available on the scheduled date.
• The Bradma Production Control System is the manufacturer's complete assurance.

It is suitable for every type of organisation – large or small – whether manufacturing turbo-jets or children's bicycles.
• The Bradma Production Control System means improved efficiency.

In every Industry, manufacturing delays are possibly the most serious and costly hazard likely to be encountered.
• The Bradma Production Control System reduces this risk to the absolute minimum.

Normal production efficiency is improved when delays and transcription errors in the preparation of factory documents are eliminated.
• The Bradma Production Control System provides the means.

There are simple hand-operated models for the smaller user, and electrically powered models incorporating many auxiliary devices for the larger user. The great advantage of the System is its adaptability. It can always be designed to solve your own particular problem.
• The Bradma Production Control System has all these features PLUS.

Bradma

For full details, without obligation, enquire today.

ADREMA LIMITED, 2-10 TELFORD WAY, LONDON, W.3

Electronic sorter-collator

AS mentioned in the article on Pan-American Airways, pp. 26, the first all-transistorised card proving machine, the IBM 108, is being utilised for card sorting and card collating. But this machine of remarkable versatility is actually able to carry out three functions in the data processing cycle; first sequence sorting and checking (both normal and selective), proving card data before it is entered into the computer and also establish control totals prior to data entry. In addition it can be used for card editing and balancing.

The machine is controlled by key switches, and a wired control panel. In this way the two card reading heads can be programmed to read and sort on up to 49 columns simultaneously; to sort cards alphabetically, sorting first normally and then by zone; to sort on one or on multiple columns as dictated by the control panel wiring; to sort cards by column distributor into various pockets; to stack cards progressively from one pocket to the next. Another interesting feature is that groups of cards can be sorted, using the punching in the group leader cards, regardless of punching in the following detail cards. Double punched columns and/or blank columns can be checked, and directed into specific pockets. Alphabetic and mixed field (containing both alphabetic and numeric information) sequence cards can be checked, using selectors and sequence checking features. In this way pre-editing multiple sorts; length of sorting (segregating cards with short names which do not have to be sorted in the same number of columns), and searching (selecting from a file all cards equal to a master card) can be carried out by means of the 108.

Using the 108 a number of arithmetic functions can be performed, such as the progress addition of totals, net balance subtraction, total transfer and the checking of a zero or non-zero balance.

In addition, the 108 can be cable connected to an output typewriter for printing out, and to a card punch for summary punching.

The input hopper of the machine holds 1,200 cards, though with the addition of an auxiliary file feed this capacity can be increased to 3,600 cards (3½ minutes continuous running time). There are two card readers capable of reading cards at 1,000 per minute, and sorting to any one of 13 pockets each with a capacity of 900 cards. The machine can be programmed to stack progressively *ie.* when one pocket fills up, the cards are transferred to the next; otherwise when the pocket fills, the machine automatically stops. The control of the 108 is via a wired control panel and by keys and switches, functional lights are provided to indicate the status of the machine and show the reason for machine stop.

The cost of the 108 is given as £900 and delivery is approximately nine months. Rental costs amount to £17 per month.

For further details tick GO5 on the reader enquiry coupon on page 43, or write to:
IBM United Kingdom Ltd,
101 Wigmore Street,
London, W1.

Sorter is multi-purpose

Printing in two typefaces

A MODIFIED Justowriter tape-operated composing machine, which incorporates an auxiliary motorised punch, is announced by Friden Ltd. This additional feature makes it possible for copy to be produced in different typefaces and sizes. The punch is cable connected to the Justowriter recorder, and as the reproducer justifies copy pre-punched on the Justowriter decoder, the punch copy codes a second tape. This second tape is passed through the reading mechanism of the justowriter recoder, to enable even lines to be composed in a different typeface. In this way reproduction proofs, and the preparation of paper and aluminium plates become an economical proposition. A further new facility of the new Justowriter is its ability to receive data in the form of edge punched cards. Formerly only tape input was possible.

The method of operation of the Justowriter can be summarised as follows:

Two electric typewriters and tape-reading heads form the basic equipment. One produces paper tape on a punch unit either from new data or from another tape reader inserting amendments. In the first case, the operator sets the tabulator keys and types the data to produce a conventional typewritten sheet and also a 7-unit tape. Approaching the end of the line, the operator is warned of the remaining capacity available, and a decision is made to hyphenate or start a fresh line. Various non-reproducing codes give additional control.

Tape editing permits substitution of one word or figure group for another, a second tape containing the amendments being used later for the printing out process.

This second tape is taken to the slave electric typewriter which has two reading heads and a small arithmetic unit situated above the tabultor stops. One reading head tells the arithmetic unit the number of characters in each line, and the unit expands or contracts spaces between words according to this information when the tape is read by the second head at the time of printing.

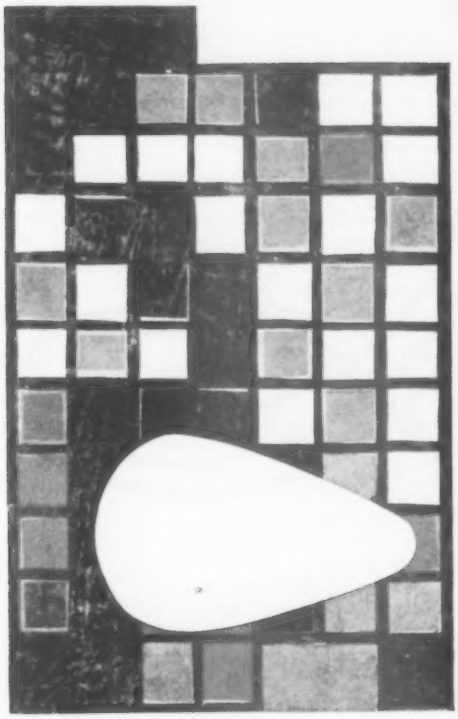
For further details tick GO6 on the reader enquiry coupon on page 43, or write to:
Friden Ltd,
4 Great Winchester Street,
London, EC2.

New Cores In Array

DUE to an American take over, a complete range of ' packaged ' ferrite core memory systems are now being marketed by Ampex (Great Britain) Ltd.

These systems, utilising square-loop ferrite core arrays, complete

continued on page 43



There's an I·C·T computer to fit your business

Shopping for a computer? Then you've a challenging task ahead. For this major investment must pay you major dividends.

Choosing and using a computer effectively and profitably requires imagination and great preparation. This means thinking in terms of the service you will get as well as the machines you will use. Doing your shopping, in fact, with an organisation having the 'know-how', the resources and the experienced staff to examine your problems creatively, and to propose the data processing system that *fits into your business.*

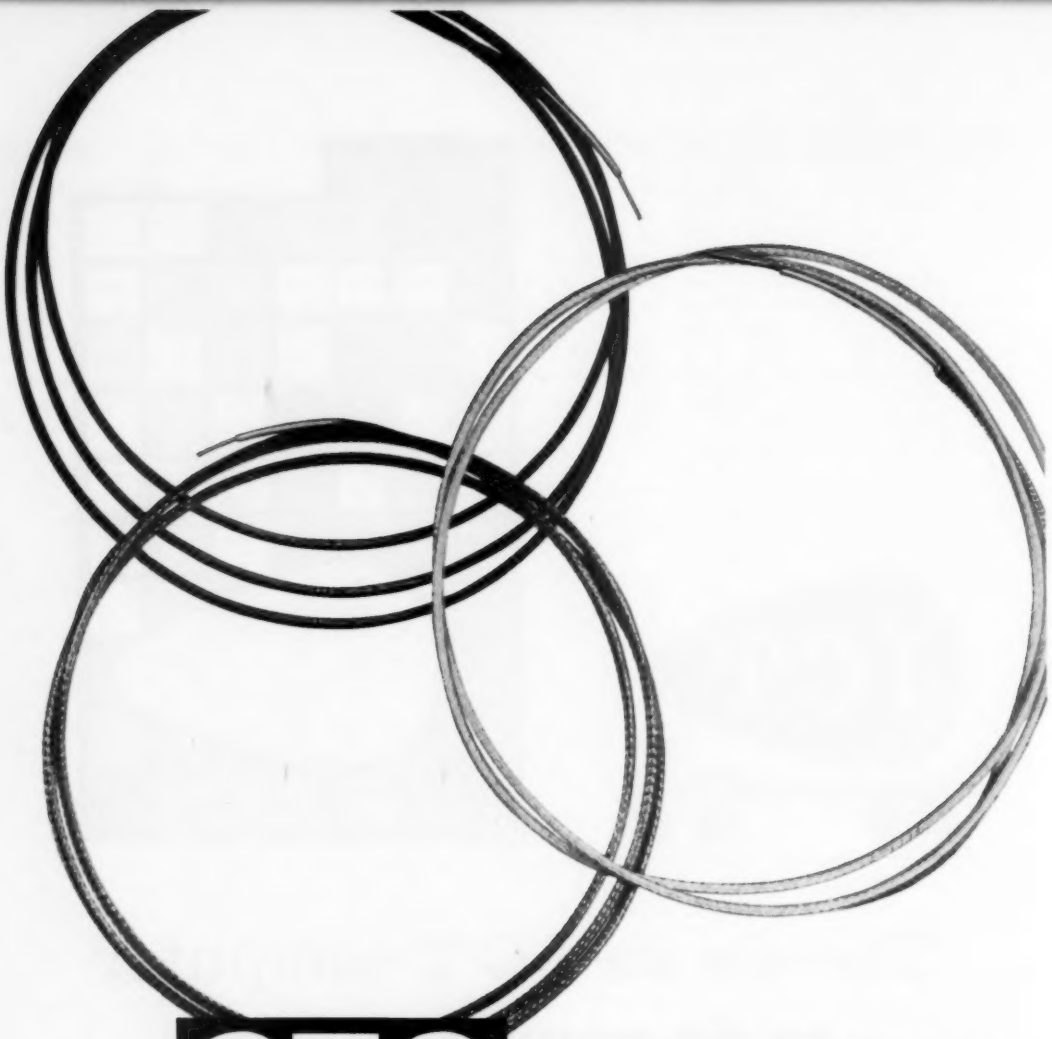
This is the specialised service that you will get from I·C·T—the largest British firm devoted exclusively to data processing, which has been its business for over fifty years.

I·C·T is at your service. There is an office near you—or write to us now.

I·C·T DATA PROCESSING

International Computers and Tabulators Limited

149 PARK LANE, LONDON, W1. OFFICES THROUGHOUT THE U.K. AND IN 51 COUNTRIES THE WORLD OVER



STC miniature high-frequency coaxial cables

Extreme Miniaturisation with Highest Tensile Strength
Overall diameter 0·064 in. to 0·078 in.

To meet the demand for progressive miniaturisation of equipment, STC have developed several types of miniature coaxial cables, with overall diameters in the range of 0·064 in. to 0·078 in. and 50 to 75 ohms impedance. The materials utilised in the construction of these cables are :—

High tensile strength, silver-plated, copperclad steel wires.

A dielectric of: Grade 2 polythene or Irradiated polythene or Polytetrafluorethylene (P.T.F.E.).

Copper wire or silver-plated copper wire braided.

Fibre glass braided and nylon sheathed, or P.T.F.E. sheathed.

Full details are given in leaflet H/202 available on request.

CABLE AND WIRE GROUP

61/2H

Standard Telephones and Cables Limited

RUBBER & PLASTIC CABLE DIVISION : CORPORATION ROAD · NEWPORT · MON.

with the necessary solid-state electronics, have been designed to perform a variety of memory operations including random access, sequential load-unload, interlace load-unload, and other functions required for digital data storage and handling.

Included as basic elements are flexibly designed memory and address registers, load and unload counters, write drivers, read amplifiers and associated control circuitry. A memory cycle of six microseconds and an access of 2·5 microseconds are typical operation times of these units.

For further details tick GO7 on the reader enquiry coupon on this page, or write to:
Ampex (Great Britain) Ltd,
Arkwright Road,
Reading,
Berks.

Computers on the Index

COMPUTER manufacturers producing a fair amount of technical literature, programming manuals, and reprints of articles, could take a leaf from the book of Ferranti Ltd, who have issued an 11-page classified index of all their computer literature.

The index is divided into six sections: first, machines and equipment —literature relating to the peripheral equipment such as tape readers, tape editing, with accompanying case histories; descriptions of all the computers in Ferranti in English, French, German and Italian, with case histories, etc; then performance tests and operating instructions, programming manuals, tape codes, ' quicky ' specifications: details of library services; and a section of applications and instructions—' a method for three dimension supersonic flutter derivatives, ' linear programming ', etc.

For further details tick GO8 on the reader enquiry coupon on this page, or write to:
Ferranti Ltd,
68–71 Newman Street,
London, W1.

Portable Digital Recording System

A CONTROL equipment which is basically designed for seismology, but could have applications in business fields, has been developed by Minneapolis Honeywell Regulator Co, the American associates of Honeywell Controls. This unit, the 6150 Incremental Digital Recording System, is a portable data logging system, which enables unattended data acquisition for long periods.

The equipment can be powered by two standard car 12-volt batteries. It records information on magnetic tape at a normal stepping speed of 30 steps per second—which at allowing for 200 steps per inch of tape gives 38 hours continuous recording on a single tape. With lower speeds, the equipment can record data automatically for as long as a year without operator intervention.

The tapes are compatible with standard Honeywell and other computers and data transcribing units, and the reels are interchangeable with any laboratory-type tape handling equipment. Thus the completed spools may be taken from the recorders at remote parts and processed in a central installation to give valuable data on oceanography water level surveys and other natural phenomena being plotted on a computer.

For further details tick GO9 on the reader enquiry coupon on this page, or write to:

Honeywell Controls Ltd,
Ruislip Road East,
Greenford, Middx.

TEAR HERE

NEW EQUIPMENT—READER ENQUIRY SERVICE

Use this reply-paid form to obtain more details on any products reviewed in the What's New Columns of this issue.
(Readers outside the United Kingdom will need to add their own postage stamps)

PLEASE TICK AGAINST THE REFERENCE NUMBERS

G00...✓	G01	G06	G07	G12	G13
G02	G03	G08	G09	G14	G15
G04	G05	G10	G11	G16	G17

Your Name .....
(PLEASE USE BLOCK LETTERS)

Position .....

Name of Firm .....

Address .....

TEAR OR CUT HERE

NEW SUBSCRIBERS

If you are not already a personal subscriber to ADP and would like to read your OWN COPY more thoroughly every month, complete the statement below.

To the Sales Director, ADP

Please send me a personal copy of ADP every month for the next 12 months, starting with the..... issue. Send the account to my firm/me personally.

Name .....
PLEASE USE BLOCK LETTERS

Position .....

Name of Firm .....

Address .....

.....

INDEX TO ADVERTISERS

Leo goes into insurance

GROUP pensions administration for the Eagle Star Insurance Company Ltd. — from individual personal records to complicated actuarial calculations — is a matter of arranging data and collating results. A Leo Automatic Office does the rest. This is, in fact, the first large scale insurance work ever carried out by a computer in this country.

Fast, accurate and automatic pensions service. LEO, working on a service basis, keeps a record of the progress of employees in Eagle Star group pension schemes. It calculates each renewal premium, contributions return, etc., printing the results as it goes. It works out the actuarial reserves required by the Company for valuations and Board of Trade returns. And it does all this accurately, quickly, and automatically.

Versatile. Over the years, LEO has been perfected for commercial work by tackling a number of complicated jobs. It has, for example, been handling payrolls, balancing accounts, issuing invoices, controlling stocks and scheduling production. The nature of many of these jobs has demanded an exceptionally high standard of reliability. In addition, the LEO Organisation operate each newly installed LEO Automatic Office until it is working at full pressure.

LEO can help you. LEO can help you increase efficiency, save space and money — whatever your organisation. If you would like to know how a LEO Automatic Office would do this for you, get in touch with LEO Computers Ltd. now.

LEO

FOR RELIABILITY
PLUS VERSATILITY
PLUS EXPERIENCE

LEO COMPUTERS LTD., HARTREE HOUSE, QUEENSWAY, LONDON W.2

CLASSIFIED ADVERTISEMENTS

RATES: APPOINTMENTS VACANT & OTHER CATEGORIES, 3s. 6d. per line (minimum 3 lines), 40s. per display panel inch. APPOINTMENTS WANTED, 3s. per line. 35s. per display panel inch. Box No. charge, 1s. extra. Address advertisements to The Classified Advertisements Manager, "Automatic Data Processing," 109–119 Waterloo Road, London, S.E.1. Tel.: WATerloo 3388 (Ext. 32).

EMI

SENIOR PROGRAMMER

EMI Electronics Ltd. requires a Senior Programmer to assume responsibility for the work of a small team concerned with general computer programming activities, data processing and system analysis.

Applicants for the post should be of good degree or equivalent standard and possess not less than four year's experience of programming or system analysis work.

Initial salary will be based on qualifications and experience and it is Company policy to review salaries annually on the basis of ability and potential.

Please write, giving full details and quoting **Ref. EL/13/A2**, to:

Personnel Manager,
E M I ELECTRONICS LTD.,
HAYES, MIDDLESEX.

PROGRESSIVE BIRMINGHAM

calculating and punched card Bureau,

employing staff of 300 and shortly intending to operate a Computer service based on an IBM 1401, requires the services of a top grade

COMPUTER MANAGER

preferably with O. & M. experience, to organise and control this Department. Commencing salary £2,000. - £2,500.

Box No. ADP 53

AUTOMATIC TELEPHONE & ELECTRIC COMPANY LTD.,

Electronic Data Handling

The Company is engaged upon the development of large data handling systems involving a variety of techniques, from computing to data presentation. Progressive vacancies occur in the following categories:

System Engineers

Education in light current electrical engineering to degree standard or equivalent is preferred. Experience in data handling techniques and/or logical design and the ability to interpret and assess customers' facility requirements in terms of system capability are of primary importance. The work requires a considerable amount of customer liaison and close co-operation with circuit design engineers.

Programmers

Electrical Engineers or mathematicians qualified to degree standard or equivalent. Experience in programming digital machines and an interest in 'logical decision' programming, rather than pure calculation, is desirable. Close co-operation with system designers and the ability to achieve a grasp of the system function and principles are a necessary part of the work.

If you are interested in this class of work please write to:

The Personnel Manager,
AUTOMATIC TELEPHONE & ELECTRIC CO. LTD.,
Strowger Works, Edge Lane, Liverpool, 7

giving details of age, qualifications and experience, and quoting ref. EDH.

Posts are on the Company's established staff with superannuation scheme and full welfare facilities. Assistance with housing will be given in approved cases.

BMEWS ...and YOU

BRITAIN'S BALLISTIC MISSILE EARLY WARNING SYSTEM

is going ahead at Fylingdales near Scarborough, Yorkshire. No electronic engineer or technician who also wants to go ahead should overlook the opportunities we offer for improving knowledge, experience and prospects by joining this project.

TRAINING *— both formal and on the job is provided free.*

EXPERIENCE *— is geared to space age concepts and ultra modern techniques and equipment.*

PROSPECTS *— stem logically from the fact that our organisation is rapidly expanding.*

We are ready to help solve such problems as where to LIVE at Sunbury-on-Thames during training, how to find ACCOMMODATION in Yorkshire, how to MOVE—and how to cover COST!
Recruiting for BMEWS is a continuous process but special opportunities arise from October, 1961 and at intervals into early 1962. You have time to think about this critical step into a new career in the following categories. But let us know your thoughts as soon as possible.

EQUIPMENT ENGINEERS

(*Ref. EQ/ENG.*) For responsible installation, check-out and technical maintenance posts within the radar, digital, display, and other sub-systems also in the data handling and communications sub-system for men with corresponding experience.
The right men will be given opportunities to acquire a thorough sub-system background, be capable of handling equipment technicalities. Qualifications—HNC or a degree are a desirable asset, and also a minimum of 5 years' practical experience.

EQUIPMENT SPECIALISTS

(*Ref. EQ/SP*) To lead technicians on the floor throughout installation and become skilled in technical trouble-shooting at sub-system level and assisting the engineers with higher order technical problems. The men we need will be technically qualified with ability to diagnose equipment troubles and should have over 5 years' experience in systems work of this type.

TECHNICIANS "A"

(*Ref. TECH. A*) For installation and integration and to assist Equipment Specialists with continuous maintenance of BMEWS electronic and electro-mechanical equipment. They will be able to use complex schematics, be familiar with electronic cabinet systems and advanced types of electronic test equipment.
Qualifications required include technical training to ONC level, plus minimum 4 years' industrial or military electronic experience.

TECHNICIANS "B"

(*Ref. TECH. B*) These posts provide good openings for skilled and semi-skilled electronic wiremen who have received some formal technical training. They will participate in complex installation work in all equipment areas and be given a training course for technician grades prior to the operation and maintenance phase, with good possibilities of promotion.
Wide knowledge of basic electronic components and several years of practical experience on high grade electronic equipment wiring is required.

Our selection demands are exacting, our techniques are up to the minute. We can arrange informal interviews to suit you—in your locality—in the evenings—at weekends. A letter to the address below, summarising your technical training and experience in your areas of interest will bring you an application form and could lead to an absorbing new career.
It is important that you mark both envelope and letter with the appropriate job reference, at the same time clearly specifying source of information.

Write now to:—The Personnel Manager, Special Projects Division,

RCA GREAT BRITAIN LIMITED

AN ASSOCIATE COMPANY OF RADIO CORPORATION OF AMERICA

Lincoln Way, Windmill Road, Sunbury-on-Thames, Middlesex

Printed for the Proprietors, BUSINESS PUBLICATIONS Ltd., *registered office: 180 Fleet Street, London, E.C.4, England* (*Waterloo 3388*) by The Alcuin Press, Welwyn Garden City, Herts.
Advertisement, editorial and sales offices: 109-119 Waterloo Road, London, S.E.1 (Waterloo 3388)

THAT Computer is now available *here!*

From today you can choose a computer—the H-800—that is already in use by many businesses similar to your own.
After exhaustive appraisal the H-800 was chosen by such experienced computer users as the Massachusetts Institute of Technology, Chrysler Corporation, Metropolitan Life, U.S. Army Finance Service, Northern Illinois Gas Company, Philadelphia Electric Company, Oregon State Motor Vehicle Bureau, Standard Pressed Steel Company.

The H-800 can be delivered within 15 months; sooner in certain circumstances.

AUTOMATIC ERROR CORRECTION

Honeywell's exclusive data-protection principle, called Orthotronic Control, makes it possible to reconstruct lost, damaged or garbled data instantly and automatically. This feature is standard.

PARALLEL PROCESSING . . . FOR I.D.P.

The H-800 has been specifically designed to allow the complete integration of all an organisation's data processing functions. Up to eight different jobs may be handled at the same time. For example the H-800 will answer a random enquiry, bring an inventory up to date, process a payroll, make a complex engineering calculation, make a special analysis, and handle *three* other jobs—*at the same time*. It uses a programming language made up from simple words . . . detects and corrects its own errors without human intervention . . . expands with the user's needs and can never be outgrown.

'ONE OF THE BEST EXAMPLES OBSERVED'

A Honeywell scheme for Integrated Data Processing was singled out in the report made by last year's O.E.E.C. mission to America as 'one of the best examples' of a plan for the integrated flow of data through a manufacturing organisation.

ENQUIRIES

Honeywell Controls Limited have established in London an Electronic Data Processing Division, and a Computer Service Bureau is being established, at which you will be able to see and use the Honeywell system.
Enquiries should be addressed to:
Electronic Data Processing Division,
Honeywell Controls Limited,
Greenford, Middlesex. Waxlow 2333.
Branch Offices in principal towns and cities in the United Kingdom and throughout the world.

Honeywell
H HONEYWELL *Electronic Data Processing*